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THE EFFECTS OF PERSONALITY TYPE AND LEARNING STYLE ON STUDENTS' LEARNING ACHIEVEMENT: HIGHER EDUCATION CASE STUDY

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Abstract. *Every learner has a distinct set of preferences that affect how they absorb new information. Some researchers argue that teaching tailored to each student's unique learning style yields better learning outcomes. However, these claims are not sufficiently supported by research data. The inconsistency of findings and the lack of consensus on this issue motivate us to conduct this experimental study. This study aimed to investigate whether there is a correlation between learning style, personality traits, and student achievement. Participants were 54 students from the Faculty of Computer Science and Engineering, St. Cyril and Methodius University in Skopje, RN. Macedonia. The research followed a quantitative research approach. The VARK and TIPI questionnaires are used to measure students' learning styles and personality traits, respectively. The results of these instruments are analyzed, and the correlational analysis with the students' learning outcomes (measured through the final exam) is conducted. The results show that there is no statistically significant effect of personality type on learning style on student performance, either when the analyses are carried out independently or in combination.*

Keywords: *learning style, personality traits, student outcomes, VARK, TIPI*

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1. INTRODUCTION

Advancements in educational technology have transformed the way teaching and learning occur at all levels of the educational process. In addition to the traditional in-person classroom setting, online and blended learning have grown in popularity as alternatives for students and educational institutions. However, the teaching and learning processes in distance learning differ from those in a traditional classroom setting (Nortvig et al., 2018; Thai, 2020). Teachers must adapt their teaching and learning activities to the new reality (Duh et al., 2017; Hristovska, 2025; Koceski, 2025; Kotevski, 2024). However, how do we know which way is the right way that provides the best outcomes for students?

Some educators believe that the characteristics of learners, such as gender, age, culture, interests, perception, competences, cognitive abilities, etc., affect both the learning process and learning outcomes (Abyaa, 2019; Yu, 2021). They had employed various strategies and tools to provide educational content in multiple formats, allowing for the individual differences of students (Chaw, 2023; Fidalgo, 2017). Their belief is supported by a systematic review conducted by Newton and Salvi (2020), which found that the majority of teachers agreed that students learn better when taught with their preferred learning style. The teacher should first determine each student's learning style and then adjust the instruction accordingly.

However, the field of learning styles is complex, and despite being studied by numerous researchers for decades, some ambiguities and disagreements remain. While some papers reported the existence of a relationship between learning style and learning outcomes (Alley, 2023; El-Saftawy, 2024; Idrizi, 2021; Marantika, 2022), there are a lot of them that claim the opposite (Aboregela, 2023; Lin, 2022; Lyle, 2023; Melzner, 2024; Rogowsky, 2020). There are also some protagonists of the new ways who criticize learning styles, and their pedagogical implications (Kirschner, 2017; Sun, 2023). They claim that there is currently no adequate empirical evidence to justify the idea of style-based instruction. The most controversial issue related to learning styles is the diversity of results obtained from various research studies, as well as the methods used in conducting these experiments. Pashler et al. (2008) state that a well-designed experiment should be conducted to obtain valid results.

The existing contradictory and controversial research findings concerning learning styles imply further exploration in this area of study. On the other hand, the learning style of the student appears to be intricately connected with their personality type (Siddiquei, 2018; Lee, 2022; Vakilifard, 2025). Personality, unlike learning style, is a relatively permanent characteristic of a person, something with which they are born, and which cannot be easily changed over time. It has been implied in the literature that personality traits affect student performance and achievement (Chen, 2025; Kohli, 2021; Sobowale, 2018; Wang, 2023). However, most of these studies are carried out with medical or economics students. To the best of our knowledge, there is no comprehensive study that involves computer science students in this type of experiment.

Despite considerable research investigating the influence of learning style and personality traits on student outcomes separately, there appears to be a scarcity of research and inconsistency in findings regarding the combined effect of these two variables on

student performance. Some evidence suggests that learning style and personality traits together may predict academic achievement (Mammadov, 2021; Sitorus, 2025), while other studies find that this is not the case (Abouzeid, 2021; Frljić, 2023).

The inconsistency in findings, as well as the implications for student education, suggest that further sound research in this area is warranted. This study aims to contribute to the research literature by determining whether there is sufficient empirical evidence regarding the influence of personality traits and learning styles on learning outcomes. The research questions expected to be answered with the study are:

- Do students' learning styles have an impact on their achievement?
- Do students' personality traits have an impact on their achievement?
- Do students' learning styles and personality traits jointly influence students' achievement?

To determine the students' learning style and personality traits, the VARK and TIPI inventories were used, respectively.

2. METHODOLOGY

2.1 Study design

This study utilized qualitative and quantitative research approaches to achieve its objectives, which included collecting data through online questionnaires (VARK and TIPI) and then analyzing the data (the Pearson Moment Correlation Coefficient, ANOVA). For this study, all participants read and signed an informed consent form at the beginning of the experiment.

2.2 Participants

For this study, the sample population was students from the Faculty of Computer Science and Engineering, Ss. Cyril and Methodius University in Skopje, RN. Macedonia. In total, 54 students (20 male and 34 female) were enrolled in two courses: the Search Engine course (C1) and the Dynamic Websites course (C2). Following voluntary participation and attrition, students were randomly assigned to two equal groups (group A and group B), each comprising 27 students. They were all informed about the experimental nature of the study at the beginning of the semester. Additionally, the use of VARK and TIPI inventories was explained to them, along with the method for completing the corresponding questionnaires.

2.3 Research procedure

Following Pashler et al.'s (2008) instructions for designing experiments related to learning styles, we divided the students into two groups (Group A and Group B). Then, one group was asked to choose the content delivery type according to their preferences, and the other group was assigned to receive instruction according to the teacher's choice. The first group could choose between offline document content (PDF documents, PPT presentations, and other materials related to the course content), offline video presentations, and online video conferences.

For the purpose of this study, two experimental courses (C1 and C2) were conducted during one semester (Figure 1). The C1 course served as an introduction to computer science, whereas C2 was more advanced and required prior knowledge of the subject. Typical tasks for the C1 course included weekly assignments, practical lab exercises, and small group projects focused on designing and implementing search engine optimization. Specifically, they analyzed search engine algorithms, evaluated ranking methods, and implemented simple crawlers or keyword-based search features. Students also completed assignments on indexing, metadata use, and SEO practices. For the C2 course, typical tasks involved designing interactive web applications using HTML, CSS, JavaScript, and PHP. Students worked on database-driven websites, implemented user authentication, and created dynamic content using server-side scripting. All participants in this study attended both courses during one semester. At the beginning of the semester, participants were asked to complete two questionnaires: one assessing their preferred learning styles (VARK questionnaire) and another evaluating their personality (TIPI questionnaire).

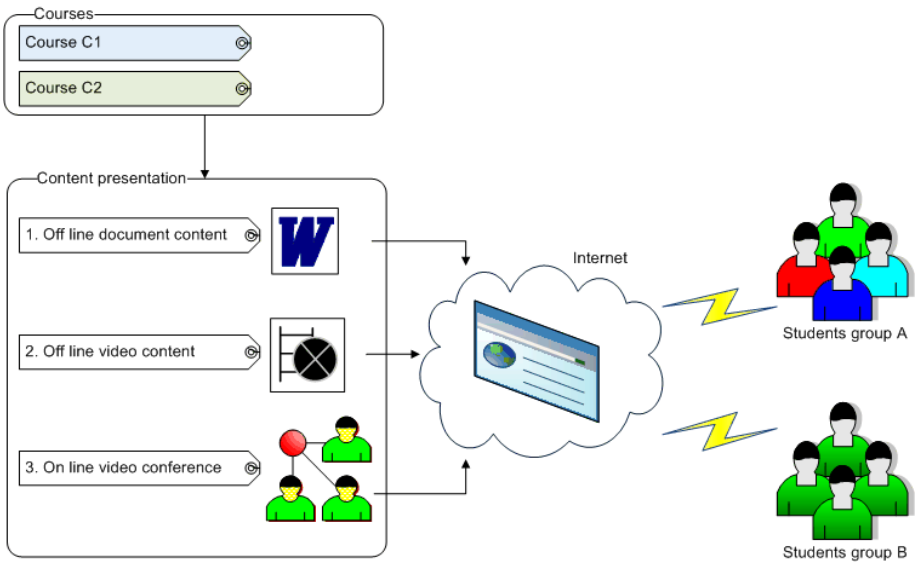

Figure 1. Educational scenarios used in the research (Vasileva-Stojanovska, 2014)

The VARK questionnaire, developed by Fleming (2001), is the most widely used due to its simplicity, ease of performance, good confidence capability, and reliability. According to this questionnaire, learning styles comprise visual (V), aural (A), reading/writing (R), and kinesthetic (K) models. Visual learners prefer to use diagrams, charts, maps, pictures, etc. They use these elements as they learn or explain something to others. Aural learners prefer to listen; they want to attend lectures, to record and listen to taped lectures or presentations, and to discuss with others and explain their ideas. Read/Write learners prefer textbooks, printed handouts, and essays. They want to take notes and organize them into outlines. Kinesthetic learners like to learn through practice and experience. They want to use experiments to understand how things function or to find a solution to a problem. The VARK questionnaire was used to classify participants into learners with a single learning style preference (uni-modal), those who utilize two learning style preferences (bi-modal), those who utilize three learning style preferences (tri-modal), or those who utilize four learning

style preferences (quad-modal). The last one is the most common result obtained from this survey.

For measuring student personality, the Ten Personality Item Inventory (TIPI) was used. This instrument, based on the Big Five personality model (Gosling, 2003), is a simple and reliable tool for measuring the five personality dimensions: extraversion, agreeableness, conscientiousness, openness to experience, and emotional stability. Extroverted individuals are typically characterized as positive, energetic, dominant, and ambitious. They want to talk and socialize with others. Individuals with a high level of agreeableness are characterized by their politeness, tolerance, trustworthiness, selflessness, emotional support, and compassion. Individuals with a high level of conscientiousness are hard workers; they are organized, reliable, and success-oriented. The openness personality trait is generally related to imagination, curiosity, creativity, originality, sophistication, and emotional stability. Emotional stability trait, also known as neuroticism, refers to the level of anxiety, anger, depression, and insecurity.

At the end of the courses, students took a final exam. The test was different for each course, but the same for all students, regardless of the group to which they belonged. Grades from these exams were taken into account when measuring student learning achievement.

2.4 Data analysis tools

In the initial research process, learning styles of the participants were determined using the VARK questionnaire. It is a simple inventory consisting of 13 questions with four options each, and participants could choose more than one option if they preferred. The VARK questionnaire was evaluated using a previously validated scoring system (Fleming, 2001).

To determine the personality of the students, the responses of the TIPI questionnaire, which includes ten questions, were analyzed. The results of the TIPI test were calculated according to the scoring instructions provided by Jonason (2011).

Course grades obtained at the final exams were used as an indicator of students' performance. Various correlation and regression analyses were employed to investigate whether and how personality traits and learning styles are associated with students' performance.

3. RESULTS AND DISCUSSION

According to the data obtained from the VARK questionnaire (Figure 2), 24 students, which is 45% of all participating students, preferred the quad-modal learning style. This means that the majority of students have strong preferences for visual, auditory, reading, writing, and kinesthetic learning styles, which will help them adapt to various learning environments and different content delivery methods. The second most preferred learning style by the students is the tri-modal style, with 17% (or nine students) of the total number of students. An equal number of participants preferred a bi-modal and an auditory learning style. Specifically, 11% of the participating students (or six students) preferred the bi-modal style as much as the auditory style. The reading/writing style is followed by 9%, or five

students, and the least preferred style is the kinesthetic style, with only 7%, or four students, of the total number of participants.

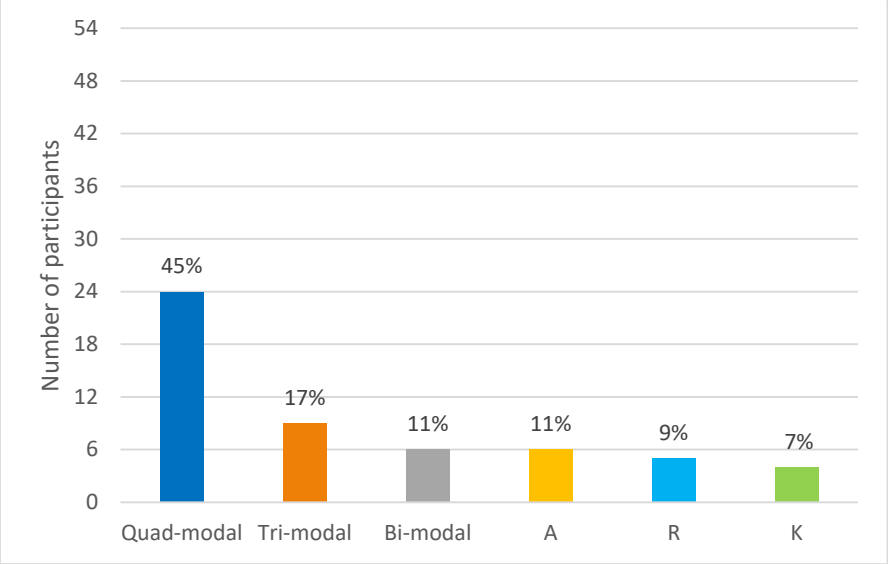

Figure 2. Frequencies of students with preferred learning styles (A-auditory, R-read and write, K-kinesthetic)

If we analyze the learning styles within the two groups created (Group A and Group B), we can determine that the preferred learning style for both groups is the quad-modal dimension. In contrast, the other dimensions differ between the groups. The tri-modal dimension, encompassing both auditory and kinesthetic aspects, is more represented in Group B, while the bi-modal and read/write dimensions are more present in Group A. However, due to the small number of participants who preferred only one learning style (for example, no participant preferred the kinesthetic learning style in Group A, and also no participant from either group preferred the visual learning style), in our research, we used the unimodal dimension, which covers all participants with a single preferred learning style.

The data from the TIPI questionnaire were analyzed to obtain students' personality traits. Results from the descriptive statistics, which depict the mean and standard deviation, are presented in Table 1.

Table 1. Descriptive statistics for personality types

Personality type	**Mean (M)**	**Standard Deviation (SD)**
Emotional	3.852	1.323
Extraversion	5.037	1.748
Conscientiousness	5.259	1.43
Agreeableness	4	1.822
Openness	4.333	2.009

The results from the final test exams were collected and analysed. Using descriptive statistics, we can confirm that Course 1 (C1) has a mean score of 4.119 (SD = 1.928), while Course 2 (C2) has a mean score of 3.315 (SD = 2.911), which is expected since C2 is a more advanced course than C1.

3.1 Learning styles and student achievement

To answer the first question, "Do students' learning styles have an impact on students' achievement?" we conducted a correlation analysis between learning styles and student achievement for both courses. The relationship between learning style and student achievement was calculated using the Pearson Product-Moment Correlation Coefficient, with an alpha of .05 based on a two-tailed significance test. Table 2 shows correlation coefficients between various learning styles and students' achievements for students participating in both courses (C1 and C2). The table shows the overall data, as well as the data divided by groups.

Table 2: Correlation coefficients between learning styles and student achievement by groups, for both courses

		Course 1			**Course 2**		
Learning style		Overall	Group A	Group B	Overall	Group A	Group B
Quad-modal	Pearson correlation Sig.(2-tailed) N	0.317 0.131 24	0.177 0.545 14	0.501 0.140 10	-0.047 0.827 24	-0.258 0.472 10	0.161 0.582 14
Tri-modal	Pearson correlation Sig.(2-tailed) N	0.447 0.228 9	sample size is too small	0.103 0.846 6	0.375 0.320 9	-0.486 0.328 6	sample size is too small
Bi-modal	Pearson correlation Sig.(2-tailed) N	-0.001 0.998 6	sample size is too small	sample size is too small	0.670 0.145 6	sample size is too small	sample size is too small
Uni-modal	Pearson correlation Sig.(2-tailed) N	0.288 0.298 15	0.608 0.200 6	0.011 0.978 9	0.001 0.997 15	0 0 9	0.884 0.019 6

Note: There is no significant correlation at the 0.05 level (2-tailed).

From the table, it can be observed that there is a mostly positive relationship between learning styles and student achievement for the C1 course (except for the overall bi-modal style, where the correlation coefficient is negative but near 0). The strongest relationship exists between uni-modal learners and student achievement for Group A ($r = 0.608$, $n = 6$), although the relationship was not statistically significant at $p < 0.05$. It should also be noted that for some styles, the correlation coefficient could not be computed due to the small sample size. For the other course (C2), the relationship differs for various learning styles; for some, it is positive, and for some, it is negative. The relationship strengths vary from -0.486 to 0.884. The number of students who preferred a particular learning style also varies. However, the relationship among all learners is not significant, not even when the data were disaggregated by groups. However, it is interesting to note that for Group A, which consists of unimodal learners, the Pearson coefficient is zero, indicating that there is no correlation between this learning style and student achievement. This is opposite to the previous course (C1), where the same learning dimension and group showed the strongest relationship. The conclusion and the answer to our question

is that students' learning style has no impact on their achievement score. These findings align with those of other researchers (Kamal, 2021; Mozaffari, 2020).

In order to investigate the existence of possible differences between the learning style dimensions and student achievement in both groups (the group in which participants choose the preferred content delivery type and the group where the teacher assigns randomly the type of educational materials delivery randomly, without taking into consideration the students' preferences), a one-way analysis of variance (ANOVA) was conducted. To determine whether any of the differences between the means are statistically significant, a comparison was made between the p-value and the significance level. The results, including descriptive statistics and the one-way ANOVA, are displayed in Tables 3 and 4, respectively.

Table 3. Descriptive statistics for learning style (by groups, for both courses)

		Course 1			**Course 2**		
Groups	Learning style	N	Mean	Std.Dev.	N	Mean	Std.Dev.
Group A	Quad-modal	14	3.93	1.96	10	2.35	2.66
	Tri-modal	3	4.33	2.55	6	1.75	2.52
	Bi-modal	4	4.95	1.17	2	4.75	6.72
	Uni-modal	6	2.97	2.34	9	2.5	2.02
	Total	27	3.91	2.0	27	2.44	2.68
Group B	Quad-modal	10	4.74	0.9	14	4.04	2.8
	Tri-modal	6	3.7	1.59	3	3.33	3.51
	Bi-modal	2	6.6	3.39	4	7.25	0.65
	Uni-modal	9	3.38	1.75	6	2.92	2.97
	Total	27	4.33	1.86	27	4.19	2.92

Table 4. A one-way analysis of variance for C1 and C2 courses

	Course 1					**Course 2**				
	Sum	df	Means	F	Sig.	Sum	df	Means	F	Sig.
Between Groups	0.627	1	0.627	0.448	0.528	4.783	1	4.783	1.71	0.239
Within Groups	8.401	6	1.400			16.784	6	2.797		
Total	9.028	7				21.567	7			

The results from Table 4 revealed that there is no significant difference between the means of each group of students and their course achievement. Therefore, we can say that the learning preferences in each group have no impact on the final test score. This is not surprising, given that the majority of students have a multimodal learning preference, which implies that they prefer information from multiple modes. This finding is also consistent with our previous study (Koceska, 2017), in which we found that the delivery of educational materials does not influence learning outcomes.

3.2 Personality and student achievement

To investigate the relationship between personality and student achievement, and to answer the second question, "Do students' personality traits have an impact on students'

achievement?", correlation analyses were conducted. Table 5 shows correlation coefficients between personality and student achievement for students who participated in C1 and C2 courses. As can be seen from the results, the relationship between all five personality traits and student grades is very weak. The highest coefficients are associated with the relationships between agreeableness and student achievement for the C1 course ($r = 0.222$, $p > 0.05$) and between conscientiousness and student achievement for the C2 course ($r = 0.227$, $p > 0.05$).

This finding aligns with the research of some scholars who have discovered that conscientiousness and agreeableness are traits that have the most significant impact on student achievement (Boonyapison, 2025; Chen, 2025). This means that students who have a high degree of conscientiousness and agreeableness performed better than those with a low degree of conscientiousness and agreeableness. However, although these relationships were the strongest in our research, they were not significant, which means that none of the five dimensions of student personality affects the students' grades. This finding, in fact, provides the answer to the aforementioned research question.

Table 5. Correlation matrix depicting the relationship between personality and student achievement for C1 and C2 courses

	Grades C1	Grades C2	Emotional	Extraversion	Conscientiousness	Agreeableness	Openness
Grades	1.000	1.000					
Emotional	-0.073	0.145	1.000				
Extraversion	0.021	-0.030	0.247	1.000			
Conscientiousness	0.079	0.227	0.081	0.117	1.000		
Agreeableness	0.222	0.062	0.117	0.385	0.355	1.000	
Openness	0.037	0.037	0.147	0.550	0.304	0.304	1.000

As an additional method, regression analysis was also conducted to determine the effects of independent variables (five dimensions of personality traits) on a single dependent variable (student grades). The results of this analysis, for both courses, are shown in Table 6.

Table 6. Results of multiple linear regression for the C1 and C2 course (personality traits predicting student achievement)

	C1 course				**C2 course**				
	SE	B	T	Sig.	SE	β	T	Sig.	SE
Emotional	0.211	-0.13	-0.618	0.54	0.315	0.329	1.042	0.303	0.315
Extraversion	0.198	-0.063	-0.316	0.753	0.297	-0.152	-0.514	0.61	0.297
Conscientiousness	0.209	0.003	0.012	0.991	0.314	0.462	1.47	0.148	0.314
Agreeableness	0.17	0.267	1.569	0.123	0.255	0.001	0.005	0.996	0.255
Openness	0.168	0.004	0.024	0.981	0.251	-0.006	-0.025	0.981	0.251

Note. There is no significant correlation at the 0.05 level of significance.

The results from the multiple linear regression analysis, for both courses, were consistent with previous findings. No statistically significant predictor variable affects student achievement. Agreeableness and conscientiousness were also variables with the highest coefficients; however, they were not significant ($t = 1.569$, $p = 0.123$ for agreeableness; $t = 1.47$, $p = 0.148$ for conscientiousness). Multiple correlation coefficients indicate a weak positive relationship. The p-values of the regression show that the set of predictors collectively was also non-significant ($p > 0.05$), and the coefficient of determination (R^2) suggests that only 6.2% (for C1) and 7.6% (for C2) of the variability in student achievement can be predicted by the personality traits.

3.3 Learning style, personality traits, and student achievement

To find the answer to the third and final research question: "Do students' learning styles and personality traits jointly influence students' achievement?", additional analyses were carried out to determine the combined significance that learning style and personality traits had on student grades. As expected, the analyses found no significant relationship for either the C1 course or the C2 course, indicating that these two variables do not have an impact on students' grades. These findings, which are consistent with those of other researchers (Abouzeid, 2021; Frljić, 2023), were somewhat expected, considering that these variables had no effect on students' achievement, nor when analyzed separately.

3.4 Practical implications

In practical terms, the findings of this study suggest that aligning instruction with learning styles is unnecessary, impractical, and time-consuming, since it involves creating multiple versions of instruction or materials and delivering them to students whose learning styles have been previously identified. Labelling students by learning style can lead to limiting beliefs about their capabilities, causing them to restrict themselves to particular modes of learning and discouraging them from engaging in diverse educational experiences. We cannot forget that great learners are adaptive and modify their learning approach in light of experience and feedback. Therefore, educators have to work to provide a high-quality education by focusing on active learning, formative feedback, and inclusive pedagogy.

4. CONCLUSIONS

This study investigated the relationship between learning style, personality type, and student achievement among computer science students. We found that the dominant learning style of the participants is quad-modal, meaning they can adapt their learning strategies to the presentation style and the context of the material being learned. However, our study revealed that even those who preferred a single learning style achieved good results on the final exam, although the presentation mode did not match the learner's preferred style. This means that the reported learning style preference was not correlated to what and how much was learned. As Knoll et al. (2017) stated, learning styles are associated with subjective, rather than objective, aspects of learning.

The results answer the research questions set at the beginning of this study:

- The learning style analysis shows that student performance is not affected by preferred learning style. These results support the idea of some researchers who claim that

knowing a student's learning style does not improve learning and its outcomes, and that there is no benefit from adapting content delivery types and teaching activities to the preferred learning style.

- The analysis of personality traits also revealed no statistically significant effect on student performance (for none of the five dimensions). In addition, research shows that a set of personality traits is a weak predictor of students' achievement, accounting for less than 8% of the variance in student outcomes.

- The research also revealed that there is no significant combined effect of both learning style and personality traits on students' achievement.

As a limitation of the study, we can mention the number of students who were included in the study. In the future, we plan to repeat the research, involving a larger number of students from different study years who will participate in various courses. This way, we will be able to monitor student achievements from a different perspective and over a longer period. Additionally, a more in-depth analysis of the participants' gender can be conducted to determine whether there are differences between the male and female populations regarding the aforementioned questions.

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ВПЛИВ ТИПУ ОСОБИСТОСТІ ТА СТИЛЮ НАВЧАННЯ НА УСПІШНІСТЬ СТУДЕНТІВ: ДОСЛІДЖЕННЯ У СФЕРІ ВИЩОЇ ОСВІТИ

Кожен здобувач освіти має власні уподобання, які визначають спосіб опанування нової інформації. Деякі дослідники стверджують, що адаптоване до індивідуального стилю навчання студента забезпечує кращі результати. Втім, такі твердження не мають достатнього емпіричного підтвердження. Непослідовність результатів і відсутність наукового консенсусу з цього питання спонукали нас провести це експериментальне дослідження. Метою роботи було з'ясувати, чи існує кореляція між стилем навчання, рисами особистості та академічними досягненнями студентів. У дослідженні взяли участь 54 студенти Факультету комп'ютерних наук та інженерії Університету імені Св. Кирила і Мефодія в Скоп'є, Республіка Північна Македонія. Дослідження здійснювалося в межах кількісного підходу. Для визначення стилю навчання та рис особистості студентів використовувалися опитувальники VARK та TIPI відповідно. Результати опитувальників було проаналізовано та проведено кореляційний аналіз із навчальними досягненнями студентів (виміряними результатами підсумкового іспиту). Отримані дані засвідчили відсутність статистично значущого впливу типу особистості та стилю навчання на результативність студентів як за умови окремого, так і комбінованого аналізу.

Ключові слова: стиль навчання, риси особистості, результати навчання, VARK, TIPI.