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Characteristics of the thinking style of student youth

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Abstract. The necessity of optimising the educational process in higher education institutions considering the requirements of the times determines the significance of addressing the psychological characteristics of its participants. The significance of the individual's thinking activity in learning and the insufficient development of the problem of its features in modern student youth have led to the purpose of the present study – to identify the style characteristics of the thinking activity of student youth. The study highlighted the findings of an empirical study of the style characteristics of students' thinking activity, conducted using a series of psychodiagnostic methods. The data obtained by each of the methods in the sample as a whole and within the following groups were analysed: boys, girls, first-year, second-year, third-year, fourth-year, and master's students. The methods of mathematical and statistical data processing were employed to determine the reliability of differences between the groups in terms of the levels of development of certain characteristics of thinking activity. As a result of applying factor analysis, eight factors were identified that structure the description of the style characteristics of students' thinking activity: creativity of the style of thinking, style of perception of information, style of evaluation of information, style of information transformation, style of operating with symbols, style of orientation of the thinking process (result), style of orientation to the quality of the result, activity of the thinking process (orientation to the search for alternatives). Based on the analysis of empirical data, it was concluded that the systemic nature of the style of thinking activity of students, the diversity of style characteristics of students' thinking activity, the presence of comparable and differing characteristics of the style of thinking activity of students of various courses and genders. The practical value of the obtained findings lies in the possibility of using them to improve teaching methods in higher education institutions, in understanding the causes of

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challenges for individual students in learning, in guiding the selection of psychodiagnostic tools in case of need to clarify the characteristics of individual parameters of the style of thinking activity

Keywords: creativity of thinking; style of perception of information; style of mental evaluation of information; psychological characteristics; operation with symbols in the thinking process; optimisation of the educational process

Introduction

The need for continuous improvement of the educational process at universities, considering the needs of the labour market and the current specific features of the development of Ukrainian society in the context of war, requires addressing the psychological characteristics of its participants to ensure their professional development. There is no doubt about the role of the cognitive sphere of the individual and their intelligence in educational activities. The well-known psychological features of the cognitive sphere in the student's age include the development of theoretical thinking and its qualities such as criticality, activity, and independence of mental activity, a pronounced desire for generalisations, development of intellectual reflection, productivity, originality of thinking. They develop a readiness for multivariate search for answers to problems that arise during learning. Intellectual development at this age lies in the formation of an individual style of mental activity, which is a kind of system of psychological tools that a person uses to solve various problems (Reva, 2022).

Psychology uses the term "cognitive style" to describe the style of mental activity, which refers to relatively stable individual characteristics of cognitive processes, manifested in the cognitive strategies used by a person, stable characteristics of thinking, perception, and memorisation. Much attention is paid by Ukrainian researchers to the issues of cognitive styles, intelligence, and its types, and the study of individual characteristics of the individual's thinking activity. N. Zabolotna & V. Omelianska (2023) noted that cognitive styles affect the regulation of human behaviour. Y. Karpenko *et al.* (2024) highlighted the relationship of emotional intelligence with various components of personality motivation. Y. Horbenko (2021) substantiated the significance of such characteristics of thinking as criticality and reflection in the modern information society, noting that they can help a person to look for alternative creative solutions. O. Zaretska (2023) pointed out the vital role of reflection as one of the intellectual and cognitive factors of a person's interpretive competence.

The development of certain characteristics of thinking, such as criticality and creativity, is being actively discussed in the world science. I. Cananau *et al.* (2025) highlighted the essence of the idea of critical thinking in the documents defining the policy of teacher training at a Swedish university. N. Xhomara (2020) substantiated the effects of personalised learning and students' previous achievements on the development of their critical thinking skills. E. Ballova-Mikuskova (2021) addressed the relationship between criticality and creativity of thought as important achievements, noting that creativity allows creating a thought, while criticality – to evaluate it, make judgements. J. Liu *et al.* (2024), exploring the "higher-level" skills needed by future citizens, included critical thinking in their list. M. Dechaume *et al.* (2024), upon studying the relationship between cognitive abilities and creativity, concluded that creative thinking is not a single general construct, but a subject-specific phenomenon (i.e., dependent on the field of creativity). M. Liang *et al.* (2024) substantiated the plasticity of divergent thinking and the possibility of its development through targeted cognitive training.

Relatively new in the modern psychological and pedagogical science is the study of clip thinking, which is considered as a process of reflecting various properties of objects without considering the connections between them, characterised by the fragmentation of the flow of information, its illogic, heterogeneity, rapid changeability, lack of integrity of perception of the surrounding world (Sobolieva, 2019). Y. Zelenov & N. Sidash (2023) substantiated the following possible impacts of clip thinking on the worldview of the younger generation: the crisis of verbal text, the changing nature of socialisation, the possibility of a person losing the ability to comprehend and create new things, and a tendency to plagiarism. Accordingly, the researchers proposed to harmoniously combine clip and conceptual thinking.

The analysis of scientific studies on the problem of learning revealed an unwavering interest in various aspects of human mental activity and attempts to study its individual components. Despite this, psychology still lacks studies that would provide a detailed and comprehensive answer to the question of individual characteristics of the thinking process in students' age. According to the researchers, finding out the style of thinking of students will facilitate the choice of forms, methods, and techniques of teaching that will help optimise the educational process. The style of thinking is understood as the individual specific features of its organisation, the specificity of the expression of certain mental qualities, the preference for operating certain mental operations over others, which affects the course and quality of solving various problems. Therefore, the purpose of this study was to examine the specific features of students' thinking activity and to identify (based on the analysis of the findings) the characteristics of their style. The scientific originality of this study lies in the empirical substantiation of the essence of the style of thinking activity of students and the description of its characteristics. The above analysis of scientific studies on the subject led to the choice of methods for investigating the complex of characteristics of students' thinking activity for further allocation of its style characteristics.

Materials and Methods

According to the outlined objectives, the study was conducted in three stages: the first stage was a pilot study, during which the selected set of methods was tested, the second stage was an empirical study of the characteristics of students' thinking activity, and the third stage was an analysis of the results and description of the characteristics of the style of thinking activity of students.

The empirical study employed a set of the following methods:

1. The L. Starkley Critical Thinking Test (adapted by O. Lutsenko (2014)) – to identify the level of development of critical thinking in general and its features: the ability to focus observations for effective problem solving, inductive thinking, persuasion techniques, logical errors, the ability to think in multiple ways, the influence of emotions on thinking, the ability to find relevant information resources, focus observations for effective problem solving, maintain attention to avoid logical errors, the ability to form problematic judgements, the ability to distinguish explanations from arguments, and use them correctly.

2. Test of creative thinking E. Torrance (1962) (verbal battery, classic version) – to study the creative productivity of the verbal thought process. The methodology diagnosed the following indicators of creative thinking: a) speed – the ability to generate numerous ideas (associations, images) in verbal form. It is measured by the number of results; b) flexibility – reflects the ability to produce multiple ideas, move from one aspect of the problem to another, and use various solution strategies. It is measured by the number of categories; c) originality – characterises the ability to produce ideas that are different from the clear, normative ones. Original solutions require the ability to refrain from producing the first answer that comes to mind, which is usually simple and standard. It is measured by the number of extraordinary answers, images, ideas.

3. L. Rebekka's Cognitive-Activity Style Diagnostic Test (activity type 5) – to determine the style of operating with ideas: synthesis or analysis.

4. Methodology for determining the type of thinking and level of creativity by S. Dmytriyeva – to identify the prevalent type of thinking: subject-action, abstract-symbolic, verbal-logical, visual-figurative, creativity.

5. Methodology "Register of information learning style" by A. Gregos – to identify the leading ways of collecting various information (professional, cognitive, life). This methodology can be used to diagnose the learning style preferred by the examinee: concrete-sequential, abstract-arbitrary, abstract-sequential, concrete-arbitrary.

6. Methodology for studying the analytical thinking (variant VI subtest of the R. Amthauer scale, 1953) – to diagnose the level of analytical thinking as a characteristic of thinking.

7. The method of studying the reflexivity of thinking – to diagnose the level of reflection of thinking, which allows developing the most effective strategy and accelerate thinking activity when solving problems.

8. Methodology for investigating the influence of attitude on the way of solving problems – to determine the rigidity and flexibility of thinking.

9. Questionnaire "Thinking Styles" by A. Harrison & R. Bramson – to identify a person's preferred way of thinking, manner of asking questions and making decisions. The methodology assumes the existence of the following thinking styles: synthesiser, idealist, pragmatist, analyst, realist.

The following methods of mathematical processing were used to analyse the findings: frequency analysis, calculation of averages and standard deviations, Fisher's angular transformation with pairwise comparison of groups, Student's t-test, factor analysis. The data were processed using SPSS.24.0 software. The description of the characteristics of the style of thinking activity of students was made based on the structural interpretive method.

This study was conducted following the principles of APA (American Psychological Association, 2024) for human research. The students were offered a Google form with a set of methods approved by the Ethics Committee of the Department of Psychology of the National University of Life and Environmental Sciences of Ukraine. The study was anonymous, the participants were informed that their answers would be treated confidentially, anonymously, all data would be analysed confidentially, anonymously, all data would be analysed in a generalised form without any conclusions about individual respondents. Participation in the study was voluntary. The respondents were full-time students of the 1st-4th year of bachelor's and 1st-2nd year of master's degrees in various specialities of the National University of Life and Environmental Sciences of Ukraine, Ivan Puluj National Technical University of Ternopil, Yuriy Fedkovych National University of Chernivtsi, totalling 296 people. The study was conducted in the spring of 2024.

Results and Discussion

The following findings were obtained during the study. According to the L. Starkley Critical Thinking Test, the vast majority of students have an average level of critical thinking (Table 1).

Table 1. *Indicators of the level of critical thinking of the respondents*

Groups of subjects	% of respondents with different levels of critical thinking					Subjects total, %
	Very high	High	Average	Low	Very low	
Boys	0	10.5	76.1	13.4	0	22.6
Girls	0.4	1.8	86.9	9.6	1.3	77.4
1st year	0	3.7	79	14.8	2.5	27.4
2nd year	1.05	6.4	78.7	12.8	1.05	31.8
3rd year	0	1.5	91.3	7.2	0	23.3

Table 1. *Continued*

Groups of subjects	% of respondents with different levels of critical thinking					Subjects total, %
	Very high	High	Average	Low	Very low	
4th year	0	0	97.3	2.7	0	12.5
Master's	0	6.7	86.6	6.7	0	5
Total in sample	0.34	3.72	84.46	10.47	1.01	100

Note: *frequency analysis data, n = 296*
Source: *experimental data*

Therewith, as presented in Table 1, this trend was observed in the study subjects regardless of gender and duration of study. The data of frequency analysis also suggested that boys were more likely to have higher rates of critical thinking than girls, and as for the duration of study at a higher education institution, the level of critical thinking of students grew with its increase. The application of Fisher's criterion with pairwise comparison of groups confirmed its partial reliability: when comparing the percentage of girls and boys with a level of critical thinking that exceeded the average level, the indicator $\varphi_{emp} = 2.61$ was obtained, which indicated a strong level of significance of differences ($p \leqslant 0.003$), and when comparing the percentage of students from year to year with a criticality level below the average, the φ_{emp} exceeded the critical values ($\varphi_{emp} = 1.77$) and reached the level of statistical significance ($p \leqslant 0.038$) only when comparing the data of the 2nd and 3rd year. Statistically significant were the differences between the first (1st, 2nd) and last (4th and Master's) year students in terms of the number of people with a level of criticality below the average – $\varphi_{emp} = 2.58$ at $p \leqslant 0.004$.

These findings suggested that the majority of students have a significant number (30-70%) of critical thinking skills – logic, induction, and deduction, the ability to critically analyse information, the ability to resist manipulation to an average degree (possibly not immediately recognising it), control emotions and understand their effects on decision-making. At the same time, these abilities still need to be developed, because such people did not correctly recognise 30% to 70% of the techniques of persuasion, distraction, and false conclusions, did not choose the optimised solution, and trusted insufficiently reliable sources of information, which was modelled in the test. For such individuals, the number of optimum solutions may be approximately equal to the number of unsuccessful solutions, but based on the knowledge of successful solutions, they may not recognise the lack of efficiency and limitations of their thinking. Therefore, students should definitely devote time and energy to its development, as it can become a serious growth potential. Therewith, greater attention should be paid to the development of critical thinking among girls and 1st-2nd-year students.

According to the creative thinking test by E. Torrance (1962) revealed indicators of speed, flexibility, and originality of thinking (Table 2).

Table 2. *Indicators of creative thinking of the respondents*

Groups of subjects	Indicators of creative thinking					
	Speed of thinking		Flexibility of thinking		Originality of thinking	
	M	Σ	M	Σ	M	σ
Boys	23.7	22.79	20.55	16.04	16.3	16.04
Girls	23.07	17.37	21.4	14.83	16.64	14.83
1st year	18.12	11.94	16.62	10.65	12.91	9.85
2nd year	21.18	19.42	19.17	16.02	15.11	16.02

Table 2. *Continued*

Groups of subjects	Indicators of creative thinking					
	Speed of thinking		Flexibility of thinking		Originality of thinking	
	M	Σ	M	Σ	M	σ
3rd year	27.46	20.65	24.99	16.71	19.03	16.71
4th year	32.02	17.71	28.86	13.99	22.3	13.99
Master's	24.6	27.1	22.53	21.35	19.8	21.35
Sample in total	23.21	18.7	21.21	15.08	16.56	15.08

Note: *descriptive statistics data, n = 296*
Source: *experimental data*

Since the methodology was not adapted to the Ukrainian sample, the obtained indicators were not compared to the normative ones, but their expression within the selected subgroups was compared. The numerical values of σ indicated in Table 2 indicate a fairly strong level of variability in the indicators of speed, flexibility, and originality of thinking both in the sample in total and within the selected subgroups.

Therewith, both in the sample in total and in its individual groups, the highest indicators were those of speed of thinking, and the lowest ones were those of originality of thinking. The average values of the studied parameters of creative thinking in the selected subgroups differed, with a tendency to increase from one year to another at the bachelor's level. However, their sequential analysis (comparison of groups by gender, 1st and 2nd, 3rd and 4th, 4th and 5th years) using Student's t-test revealed statistically significant differences only in the speed of thinking of 2nd and 3rd year students ($t = 1.97$ at $a \leqslant 0.05$). The application of this criterion to compare the indicators of creative thinking in 1st and final year bachelor's students confirmed the statistical significance of differences in speed ($t = 4.34$ at $a \leqslant 0.001$), flexibility ($t = 4.88$ at $a \leqslant 0.001$), and originality ($t = 3.69$ at $a \leqslant 0.001$) of thinking, which is explained by their growth with the experience of studying at a higher education institution. That is, although the growth of the ability to generate many ideas in verbal form, to put forward a variety of ideas, to move from one aspect of the problem to another, to use various solution strategies, to put forward ideas that differ from the normative ones may be little noticeable from year to year, it becomes clear when comparing students of the initial and final stages of study.

According to the L. Rebekka cognitive-activity style diagnostic methodology, it was found that the majority of students had a synthetic style of operating with ideas over the analytical one (Table 3).

Table 3. *Distribution of subjects by indicators of prevalence of thinking operations*

Groups of subjects	Distribution of subjects, %		
	Synthesis prevails	Analysis prevails	Balanced analysis and synthesis
Boys	45	45	10
Girls	56	32	12
1st year	46	28	12
2nd year	55	32	13
3rd year	50.7	40.6	8.7
4th year	54	35	11
Master's	46.7	40	13.3
Sample total	53	35	12

Note: *frequency analysis data, n = 296*
Source: *experimental data*

Such trend was observed in each year and in the group of girls, but in the group of boys, both analysis and synthesis were prevalent with equal frequency. Therewith, the application of Fisher's angular transformation criterion helped to establish that the proportion of girls with synthesis prevalence did not significantly exceed that of boys (φ_{emp} = 1.58 at p ⩽ 0.057). Thus, the data obtained suggested that most students tended to think in general categories, easily grasp the central idea, general meaning, and connection, even if they did not know all the words in the concepts of the topic being taught. Therewith, there was also a considerable proportion of students who focused on their partial contrast and logical analysis, who did not have a clear picture. Only a small proportion of students could easily operate with general categories and logical analysis of details.

According to the methodology for determining the type of thinking and the level of creativity, it was found that the majority of the sample is characterised by a high level of object-action, an average level of abstract-symbolic, an average level of verbal-logical, a high level of visual-figurative thinking, and a high level of creative thinking (Table 4). This tendency was observed in all groups of subjects, except for the prevalence of students with a high level of verbal and logical thinking in the 4th year and an average level of creative thinking in masters.

Table 4. *Distribution of respondents by indicators of prevalence of the type of thinking*

Group of subjects	% of subjects with different levels of subject-action thinking			% of subjects with different levels of abstract-symbolic thinking			% of subjects with different levels of verbal-logical thinking			% of subjects with different levels of visual-figurative thinking			% of respondents with different levels of creative thinking		
	Low level	Average level	High level	Low level	Average level	High level	Low level	Average level	High level	Low level	Average level	High level	Low level	Average level	High level
Boys	3	51	46	34	51	15	10	63	27	3	48	49	1.5	40.3	58.2
Girls	0.9	45.4	53.7	41.5	48.9	9.6	7.4	54.6	38	1.8	21.8	76.4	1.3	39.3	59.4
1st year	1.2	46.9	51.9	27	59	14	5	60	35	1.2	28.4	70.4	0	42	58
2nd year	2.1	47.9	50	46.8	44.7	8.5	12.8	60.6	26.6	3	33	64	2	35	63
3rd year	0	45	55	45	45	10	6	49	45	1.5	24.6	73.9	0	42	58
4th year	0	46	54	37.8	48.7	13.5	8	43	49	2.7	21.6	75.7	2.7	32.4	64.9
Master's	6.6	46.7	46.7	46.7	46.7	6.6	6.6	66.7	26.7	0	20	80	6.7	60	33
Sample in total	1.4	46.6	52	40	49	11	8	56	36	2	28	70	1.4	39.5	59.1

Note: *frequency analysis data, n = 296*
Source: *experimental data*

The data in Table 4 suggest that among girls there was a greater proportion of those with a high level of object-action, verbal-logical, and visual-figurative thinking; a greater proportion with a low and smaller proportion with a high level of abstract-symbolic thinking; and in terms of the distribution of levels of creative thinking, boys and girls were approximately the equal. Its verification using the Fisher's angular transformation criterion confirmed the presence of significant differences in the percentage of boys and girls with a low level of abstract-symbolic thinking (φ_{emp} = 1.84 at p ⩽ 0.033), high verbal-logical (φ_{emp} = 1.69 at p ⩽ 0.046), and visual-figurative thinking (φ_{emp} = 4.15 at p ⩽ 0.001). Thus, boys and girls arguably had approximately the same distribution of diverse types of thinking, but boys were significantly less likely to have low levels of abstract and symbolic thinking, while girls were significantly more likely to have high levels of verbal and logical and visual and imaginative thinking.

According to the methodology "Register of Information Acquisition Style" by A. Gregos, the distribution of the subjects by the prevalence of the method of collecting various information (professional, cognitive, life) was revealed – concrete-sequential, abstract-arbitrary, abstract-sequential, concrete-arbitrary, mixed (Table 5).

Table 5. *Distribution of the research subjects by indicators of prevalence of the information acquisition style*

Groups of subjects	% of respondents with the prevalence of concrete-sequential style	% of subjects with a prevalence of abstract-arbitrary style	% of subjects with a prevalence of abstract-sequential style	% of subjects with a prevalence of concrete-arbitrary style	% of subjects with the prevalence of mixed style
Boys	29.9	9	32.8	13.4	14.9
Girls	28	12	20	18	22
1st year	26	9	27	22	16
2nd year	28	14	18	16	24
3rd year	29	9	17	22	23
4th year	27	8	35	8	22
Master's	46.6	26.7	26.7	0	0
Sample in total	28.4	11.1	23	17.2	20.3

Note: *frequency analysis data, n = 296*

Source: *experimental data*

The data in Table 5 suggest that the sample in total and each of its groups had students with various prevalent styles of information acquisition. Therewith, in the sample in total and in most groups, the proportion of people with the prevalent concrete-sequential style of information acquisition was greater, while in the groups of boys, 1st- and 4th-year students – abstract-sequential. The difference in the percentage of boys and girls with a prevalent abstract-sequential and mixed style of information acquisition is noteworthy. The application of the Fisher's angular transformation criterion indicated statistical significance of the difference in the prevalence of the abstract-sequential style of information acquisition (φ_{emp} = 2.11 at p ⩽ 0.017) and its absence in the mixed style. Thus, among boys, the prevalence of the abstract-sequential style of information acquisition was significantly more frequent than among girls, which ensured separation, analyticality, logic, abstractness, evaluation, and rationality in the perception of information.

The methodology for studying analytical thinking revealed the prevalence of the proportion of students with an average level of analytical thinking in the sample in total, among boys and girls, but the unequal distribution of the percentage of students with various levels of its development in different years of studying (Table 6).

Table 6. *Distribution of respondents by indicators of analytical thinking*

Groups of subjects	M level of analytical thinking	σ	% of respondents with a low level of analytical thinking	% of respondents with an average level of analytical thinking	% of respondents with a high level of analytical thinking
Boys	6.93	4.47	34	45	21
Girls	7.42	4.93	34.5	35	30.5
1st year	6.14	4.89	45.7	35.8	18.5

Table 6. *Continued*

Groups of subjects	M level of analytical thinking	σ	% of respondents with a low level of analytical thinking	% of respondents with an average level of analytical thinking	% of respondents with a high level of analytical thinking
2nd year	7.14	4.92	39	30	31
3rd year	7.93	4.2	23	51	26
4th year	8.89	4.64	19	38	43
Master's	7.87	6.16	33	27	40
Sample in total	7.3	4.1	35	37	28

Note: *descriptive statistics and frequency analysis data, n = 296*
Source: *experimental data*

Table 6 demonstrates the prevalence of students with low levels of analytical thinking in the 1st and 2nd years of study, with an average level in the 3rd year and a high level in the 4th year and among master's students, an increase in the average values of the analytical thinking indicator from the 1st year to the 4th year with a considerable dispersion of indicators in the selected groups, as well as differences in the frequency of high levels of analytical thinking between boys and girls. The Student's t-test was employed to verify the statistical significance of the differences in the mean values of the indicators of analytical thinking of students of different years, but no significant differences were found from year to year. To test the reliability of differences in the frequency of high levels of analytical thinking between girls and boys, the Fisher's angular transformation criterion was applied. However, no significant differences were found ($\varphi_{emp} = 1.57$ at $p \leqslant 0.058$).

The methodology for studying reflexivity of thinking revealed the proportion of students with its high level both in the sample in total and in each of the selected groups, with differences in the dispersion of the indicator values in the groups (Table 7).

Table 7. *Distribution of the subjects by indicators of reflective thinking*

Groups of subjects	M level of reflective thinking	σ	% of subjects with a low level of reflective thinking	% of respondents with an average level of reflective thinking	% of respondents with a high level of reflective thinking
Boys	8.84	4.99	25.4	31.3	43.3
Girls	11.03	4.54	11	25	64
1st year	9.42	5.26	25	22	53
2nd year	10.26	4.5	13	32	55
3rd year	11.8	3.72	1	32	67
4th year	12.27	3.54	5	19	76
Master's	8.2	7.02	40	13	47
Sample in total	10.5	4.67	14	27	59

Note: *descriptive statistics and frequency analysis data, n = 296*
Source: *experimental data*

Table 7 shows an increase in the average value of reflectivity from year to year among bachelor's students, as well as differences in the average values of the reflectivity indicator for boys and girls and in the percentage of boys and girls with a high level of reflectivity. The Student's t-test was employed to verify the reliability of differences in the mean values of reflectivity

indicators of students of different courses and genders. The application of the Student's t-test revealed statistically significant differences in the level of reflexivity of boys and girls (t = 3.2 at a ⩽ 0.001), but did not reveal significant differences in the average level of reflexivity between students of different years (1st and 2nd, 2nd and 3rd, 3rd and 4th, 4th and Master's).

The application of the Fisher's angular transformation criterion showed that the percentage of girls with a high level of reflexivity is statistically significantly greater than that of boys (φ_{emp} = 3.02 at p ⩽ 0.001). Thus, most students were characterised by a high level of reflective thinking, which allows developing the most effective strategy and accelerate thinking activity when solving problems. Therewith, among girls, a high level of reflective thinking was significantly more frequent.

According to the methodology of studying the influence of attitude on the way of solving problems, the following indicators of students' rigidity and flexibility of thinking were revealed (Table 8).

Table 8. *Distribution of subjects by indicators of rigidity/flexibility of thinking*

Groups of subjects	% of respondents with flexibility of thinking	% of subjects with rigidity of thinking
Boys	19	81
Girls	21	79
1st year	9	91
2nd year	21	79
3rd year	29	71
4th year	27	73
Master's	27	73
Sample in total	21	79

Note: *frequency analysis data, n = 296*
Source: *experimental data*

The data in Table 8 indicate that most students, regardless of gender and duration of study at a higher education institution, were characterised by rigidity of thinking, which manifested itself in difficulties in switching from one way of solving problems to another. According to the questionnaire "Thinking Styles" by A. Harrison & R. Bramson, the following indicators of the desired way of thinking, manner of asking questions, and making decisions were diagnosed (Table 9).

Table 9. *Distribution of respondents by indicators of their preferred style of thinking*

Groups of subjects	% of respondents with the desired style of thinking					
	Synthesiser	Idealist	Pragmatist	Analyst	Realist	Mixed type
Boys	7.5	7.5	4.5	44.7	19.4	16.4
Girls	8	10.9	10	33.6	17	20.5
1st year	5	9	4	34	12	17
2nd year	11	12	8.5	25.5	23	20
3rd year	4	6	13	38	19	20
4th year	8	16	11	46	8	11
Master's	13	0	7	40	13	27
Sample in total	8	10	9	36	17.5	19.5

Note: *frequency analysis data, n = 296*
Source: *experimental data*

The data in Table 9 show that students identified distinct types of thinking styles as desirable for themselves, but the most frequently preferred thinking style was analytical both in the sample in total and in its individual groups. Therewith, boys chose this style of thinking more often than girls. The application of Fisher's angular transformation criterion confirmed the statistical significance of such differences ($\varphi_{emp} = 1.64$ at $p \leqslant 0.05$). That is, students were more likely to choose a style of thinking that uses a deductive approach, strive for models and formulas, express interest in "scientific solutions", pay attention to practical data and concrete details, and are better equipped to navigate structured, calculable situations. At the same time, there may be a tendency to polarised "black and white" thinking, inflexibility, and excessive demands for predictability.

To find out the most significant characteristics of students' thinking activity, the empirical data obtained were analysed using the factor analysis method. As a result, 8 factors were obtained, describing 66% of the sample (Table 10).

Table 10. *Selected factors and their components*

Characteristics of thinking activity – components of factors	Factors							
	1	2	3	4	5	6	7	8
Criticality of thinking	.309	-.218	.449	-.152	-.046	.020	.074	.352
Speed of thinking	.817	-.394	-.287	-.004	-.019	.000	-.116	.000
Synthesis indicator	.136	.306	-.051	.121	.153	.129	.332	.115
Analysis indicator	.464	-.200	-.374	-.169	.067	.067	-.054	.007
Subject-action	.135	.122	.056	.612	-.086	.131	-.153	-.212
Abstract-symbolic	.193	.160	.189	-.002	.528	.259	-.099	-.095
Verbal-logical	.398	.352	-.030	-.213	.251	.124	.380	.275
Visual-figurative	.330	.278	-.049	.070	.353	-.086	.424	.271
Creativity	.209	.238	-.024	.599	.017	.023	-.090	-.111
Concrete-consistent style	.402	.682	-.058	-.065	-.119	-.094	-.033	-.072
Abstract-arbitrary style	.415	.740	.039	-.060	-.142	-.057	-.082	-.032
Abstract-sequential style	.423	.601	.206	-.189	-.150	-.118	-.226	-.046
Concrete-arbitrary	.381	.625	.189	-.086	-.267	-.104	-.054	-.098
Analyticality of thinking	.337	-.311	.458	.196	.037	.280	.191	-.110
Reflectivity of thinking	.382	-.145	.420	.292	-.214	.058	.217	-.129
Rigidity/flexibility of thinking	.206	-.175	.312	.300	-.048	-.024	.309	-.072
"Synthesiser" style	-.119	.200	-.140	.385	-.130	.327	-.340	.684
"Idealist" style	-.100	.294	-.405	-.057	.348	.384	.082	-.459
"Pragmatist" style	-.072	-.049	-.447	.176	-.370	-.442	.471	-.033
"Analyst" style	.153	-.185	.513	-.009	.483	-.568	-.255	-.035
"Realist" style	.086	-.187	.346	-.452	-.441	.440	.088	-.109
Flexibility of thinking	.822	-.407	-.271	-.004	-.021	-.015	-.103	.000
Originality of thinking	.825	-.410	-.292	-.015	-.010	-.003	-.133	-.009

Note: *frequency analysis data, n = 296*

Source: *experimental data*

The data in Table 10 demonstrate the completeness of the factors with the following principal components (determined by their maximum loadings within the factors):

- factor 1: speed of thinking, analysis, verbal and logical thinking, flexibility and originality of thinking;
- factor 2: concrete-sequential style, abstract-arbitrary, abstract-sequential, concrete-arbitrary;
- factor 3: critical thinking, analytical thinking, reflective thinking, preferred style of thinking "analyst";
- factor 4: subject-action thinking, creativity of thinking, undesirable style of thinking "realist";
- factor 5: abstract and symbolic thinking;
- factor 6: undesirable style of thinking "analyst", desirable – "realist";
- factor 7: synthesis, visual and figurative thinking, rigidity/flexibility of thinking, preferred style of thinking "pragmatist";
- factor 8: preferred style of thinking "synthesiser", undesirable "idealist".

According to the data on the maximum load of components within the identified factors and their semantic interpretation, the factors were named as follows:

- factor 1 – creativity of the style of thinking;
- factor 2 – style of perception of information;
- factor 3 – style of information evaluation;
- factor 4 – style of information transformation;
- factor 5 – style of operating with symbols;
- factor 6 – style of orientation of the thinking process (on the result);
- factor 7 – style of orientation to the quality of the result;
- factor 8 – activity of the thinking process (focus on the search for alternatives).

Thus, the procedure of factor analysis helped to reduce the large dimensionality of the data and structure the characteristics of thinking activity by eight factors that reflect various aspects of the style of the thinking process. The data obtained served as the basis for a systematic description of the style characteristics of students' thinking activity. Specifically, this study identified a series of style characteristics of students' thinking activity.

In terms of creativity in the style of thinking, a high level of variability in the indicators of speed, flexibility, originality of thinking, and their growth in the last year of study compared to the first year (i.e., with increasing learning experience, students' ability to generate a considerable number of ideas in verbal form, to put forward a variety of ideas, to move from one aspect of the problem to another, to use various solution strategies, to put forward ideas that differ from the normative ones); the tendency of the majority to think in general categories, to easily grasp the main idea, general meaning and connection without going into details; well-developed verbal and logical thinking in the vast majority of students.

In the context of information perception style: resorting to different styles of information acquisition, the majority – to concrete and consistent (i.e., tend to show fascination, receptivity, sensitivity, acceptance, intuitiveness, specificity, focus on the present, openness to new things, experience, intensity). Therewith, the prevalence of the abstract-sequential style of information acquisition was much more frequent among boys than among girls, which ensures separation, analytical, logical, abstract, evaluative, rationality in the perception of information.

In the style of information evaluation, the study found the prevalence of an average level of critical thinking (i.e., the majority of students had a significant number (30-70%) of critical thinking skills – logic, induction, and deduction, the ability to critically analyse information, the ability to resist manipulation, control emotions and awareness of their effects on decision-making), an increase in criticality among senior students compared to the first year students; furthermore, high levels of critical thinking were more frequent among boys than girls; diversity of levels of analytical thinking, regardless of the period of study at a higher education institution and gender; a high level of reflexivity of thinking, which helps to develop the most effective strategy and accelerate thinking activity when solving problems, while among girls a high level of reflexivity of

thinking is much more common; the most desirable style of thinking is analytical (and for boys more than for girls), which uses a deductive approach, a desire for models and formulas, an interest in "scientific solutions", practical data, and specific details, and orientation in structured situations.

In terms of the style of information transformation: well-developed subject-action thinking, i.e., thinking that provides cognition through movements, its high level for most students regardless of age and gender; well-developed creative thinking, which helps to find non-standard solutions; undesirability for the vast majority of "realist" style of thinking, which uses an empirical, inductive approach, focus on concrete results.

In the study of the style of operating with symbols, it was noted that abstract and symbolic thinking reached a high level of development in a small part of students, about half had an average level of development, a little less than half – a low level, while girls had a low level of development significantly more often than boys. That is, most students had difficulties with mathematical codes, formulas, and operations.

In terms of the style of orientation of the thinking process (on the result): a greater focus on the deductive approach than the inductive one. A considerable number of students, especially girls, did not identify a way of thinking that involves a formal-logical approach, focused on the use of models and formulas, and attention to detail as desirable. As a result, they may have difficulty planning, not considering concrete details and practical data. A small proportion of students employed the "realist" style of thinking, i.e., they relied more on their experience, facts and opinions of experts, were interested in concrete results, and tended to adjust their conclusions.

As for the style of focusing on the quality of the result: prevalence of the tendency to think in general categories, to easily grasp the main idea, general meaning and connection, even if they do not know all the words in the concepts of the topic under study; high level of visual and figurative thinking, which is closely related to imagination (its high level was significantly more common in girls than in boys); insufficient flexibility of thinking, which is manifested in the difficulty of switching from one way of solving problems to another; pragmatic thinking in a small proportion of students, which is manifested in interest in innovation, the desire to get the most out of the shortest possible time, and to apply an eclectic approach to solving problems.

The analysis of the activity of the thinking process (orientation towards the search for alternatives) revealed the following: a tendency of a small proportion of students to propose alternative solutions, to notice contradictions, manifestation of fact-centredness, focus on available data in most students.

The findings of the empirical study described above and their analysis correlated with the results of studies by other researchers – both Ukrainian and psychological researchers from other countries. Specifically, N. Akimova *et al.* (2022) argued that the greater the level of speech and thinking development in adolescence, the more active the reading of texts, the better the prediction of their content from pictures and interpretation. The current study found that the indicators of creative thinking (speed, flexibility, originality) form one factor in students' thinking along with mental analysis and verbal-logical thinking, which is consistent with the above data.

When considering cognitive styles in the context of self-preservation behaviour N. Pyliavets (2023) empirically found that self-preservation behaviour is associated with analytical and reflective thinking. The researcher obtained the following indicators of reflexivity and analytical thinking on a sample of 130 students of the Vinnytsia Academy of Continuing Education: none of the respondents showed a pronounced analytical thinking, 21.54% of respondents had a low level of reflexivity, 36.92% had a high level, and 51.54% had an average level. In the current study, somewhat different indicators were obtained: a significant proportion of students with a high level of analytical thinking was found – 28%; as for

reflective thinking, the smallest proportion also included students with a low level – 14%, but the largest proportion was the share of people with a high level – 59%.

E. Balashov & V. Kalamazh (2020) described the features of reflective skills at the cognitive level and students' reflective abilities to self-regulation, which they use when solving a problem. The researchers noted that the overall level of the subjects' reflective abilities at the cognitive level was average. In the current study, the average reflexivity index obtained in the sample reached a high level, which may further indicate individual differences in the style characteristics of students' thinking activities.

I. Kariaka *et al.* (2020) investigated the specific features of the manifestation of thinking styles in the communication activities of young men. The following types of thinking were diagnosed: synthetic (synthesiser), idealistic, pragmatic, analytical, realistic, and compared with their manifestations in communication. The study was conducted on a small sample (40 people) and the following distribution of respondents by prevalent thinking styles was obtained: 35% had a realistic style of thinking, 30% – analytical, 20% – pragmatic, 10% – idealistic, 5% – synthetic. In the current study, this distribution differed in terms of realistic (only 17.5% of respondents had a realistic style of thinking) and pragmatic styles (only 9%) and was comparable in terms of analytical (36%), idealistic (10%), and synthetic (8%) styles of thinking.

The findings obtained by the methodology for determining the type of thinking and the level of creativity are in line with the results of the study of students' types of thinking by T. Lysianska (2020). Specifically, the researcher paid attention to the following types of thinking: substantive, figurative, iconic, and symbolic. In an empirical study, T. Lysianska (2020) found that most students have symbolic thinking, which is based on subject-figurative thinking. The current study also found that most subjects (70%) had a high level of visual-figurative thinking, and almost all the rest have an average level. Factors 2 (style of information perception) and 4 (style of information transformation) obtained in this study correlated with the understanding of the essence of cognitive style accepted in psychological science: cognitive style is a model of human processing of cognitive tasks, their perception, memorisation, and thinking (Sender, 2020). The researcher experimentally proved that the effectiveness of students' (future engineers') learning activities was directly related to the compliance of the learning strategy with their cognitive style. In the present study, the researchers proceeded from an analogous idea: the compliance of teaching methods, tools, and techniques with the style characteristics of students' thinking activities would contribute to the better effectiveness of the educational process.

Conclusions

The theoretical analysis of the problem of specific features of students' thinking activity, as well as the analysis of the findings of the empirical study, helped to formulate a series of conclusions about the style of thinking activity of students and its characteristics. Specifically, the style of thinking activity of students is a systemic characteristic of their thinking activity, which includes indicators of creativity of thinking, specific features of perception, evaluation, and transformation of information, operation with symbols, orientation of the thinking process to the result and its quality, activity of the thinking process (its focus on finding alternatives, operating with factual data). Due to the representation of the style of thinking activity of students by a considerable number of indicators, there was a wide variety of style characteristics of students' thinking activity. According to some style characteristics of thinking activity, most students are similar: an average and higher level of critical thinking, well-developed subject-action, verbal-logical, visual-figurative style of thinking and creativity.

Differences in the style characteristics of thinking activity of boys and girls of student age were as follows: boys were more likely than girls to have high rates of critical thinking, to choose

an analytical style of thinking, to prefer an abstract and sequential style of information acquisition, which ensures separation, analytical, logical, abstract, evaluative, rationality in the perception of information; a low level of abstract and symbolic thinking was much less frequent than in girls; girls were much more likely to have a high level of verbal-logical and visual-figurative thinking, a high level of reflexivity of thinking.

Differences in the style characteristics of students depending on the period of study at a higher education institution were manifested in a decrease in the proportion of students with a low level of criticality in the senior year of a bachelor's degree compared to the first year, in the growth of indicators of speed, flexibility, and originality of thinking in the senior year of a bachelor's degree compared to the first year. To ensure the effectiveness of learning, it is vital to consider the style characteristics of students' thinking when teaching and formulating tasks for independent work. The development of recommendations for the consideration of the style characteristics of students' thinking activity in the educational process and testing their effectiveness constitute the essence of further research.

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Conflict of Interest

None.

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Характеристика стилю мисленнєвої діяльності студентської молоді

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Анотація. Необхідність оптимізації освітнього процесу в закладах вищої освіти з огляду на вимоги часу зумовлює важливість урахування психологічних характеристик його учасників. Значущість мисленнєвої діяльності особистості в навчанні та недостатня розробленість проблеми її особливостей у сучасної студентської молоді зумовили мету дослідження авторів – виявити стильові характеристики мисленнєвої діяльності студентської молоді. У статті висвітлені результати емпіричного дослідження стильових характеристик мисленнєвої діяльності студентської молоді, проведеного за допомогою низки психодіагностичних методик. Проаналізовано дані, отримані за кожною із методик у вибірці загалом та в межах таких груп: хлопці, дівчата, студенти першого курсу, другого курсу, третього курсу, четвертого курсу, магістратури. За допомогою методів математико-статистичної обробки даних з'ясовано достовірність відмінностей між групами за рівнями розвитку окремих характеристик мисленнєвої діяльності. У результаті застосування факторного аналізу виокремлено вісім факторів, за якими структуровано опис стильових характеристик мисленнєвої діяльності студентської молоді: креативність стилю мислення, стиль сприймання інформації, стиль оцінювання інформації, стиль перетворення інформації, стиль оперування символами, стиль орієнтування мисленнєвого процесу (на результат), стиль орієнтування на якість результату, активність мисленнєвого процесу (орієнтованість на пошук альтернатив). На підґрунті аналізу емпіричних даних зроблено висновок про системну сутність стилю мисленнєвої діяльності студентської молоді, різноманітність стильових характеристик мисленнєвої діяльності студентства, наявність схожих та відмінних характеристик стилю мисленнєвої діяльності у студентів різних курсів та різних статей. Практична цінність отриманих результатів полягає у можливості їх використання для вдосконалення методики викладання у закладах вищої освіти, у розумінні причин труднощів окремих студентів у навчанні, в орієнтації підбору психодіагностичного інструментарію у випадку необхідності з'ясування характеристик окремих параметрів стилю мисленнєвої діяльності

Ключові слова: креативність мислення; стиль сприймання інформації; стиль мисленнєвого оцінювання інформації; психологічні характеристики; оперування символами у мисленнєвому процесі; оптимізація навчального процесу