

Developing students' cognitive resistance to information manipulation through critical thinking: Practical aspects^{*}

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Abstract

This article is devoted to the problem of forming students' critical thinking through the development of their conflict and emotional competence skills in a digital environment. This research is the next achievement of the implementation of the EU Erasmus+ project "Peace Education for Consolidated and Human-Centered Europe" (Grant Agreement No. 101094420 PeaECH) at Borys Grinchenko Kyiv Metropolitan University. During the testing process within the framework of this project of the discipline "The Art of Managing Emotions and Conflicts", it was determined that a methodological training system has been developed, namely, a practice-oriented approach (simulations, role-playing games, internships) and the implementation of modern information and communication technologies (virtual simulations, online courses, mobile applications, AI), aimed at developing skills for safe information processing based on mastering techniques for managing emotions and conflicts. In order to determine the effectiveness of the proposed methodology, a pedagogical experiment was conducted. At the first stage, before studying the discipline, self-assessment questionnaires of critical thinking were used, which include the features of working with information according to the following parameters: readiness to check sources, identification of data reliability, ability to form and clarity of position expression. At the second stage, after studying the discipline, an adapted objective test of critical thinking by Starkey was used. The results show that students who possess emotional intelligence skills better resist the influence of cognitive biases and emotional manipulations when interacting with information, which contributes to the development of critical thinking in a digital environment.

Keywords

Cognitive skills, emotion management, conflict management, information manipulation, critical thinking, digital security, methodology, empirical research.

1. Introduction

Radical rapid changes in modern society, which are caused by digitalization and the introduction of intelligent information and communication technologies, put forward new requirements for the system of professional education, in particular for the training of management specialists. The integration of artificial intelligence in process management changes the philosophy of management itself. Digital systems themselves determine the most priority risks and offer ready-made solutions, thereby forming the prerequisites for the cognitive passivity of the manager. Human decision-making is often reduced to algorithmic prompts and advice, managerial subjectivity is lost, and the habit of delegating choices to artificial intelligence is developing. Among the most significant threats is that the manager, having become a hostage to the system, loses the ability to independently analyze information to make managerial decisions. At the same time, cognitive reflection decreases, the skills of logical analysis and fact-checking gradually deteriorate, which leads to the atrophy of critical thinking skills. This is indicated by the results of empirical studies: the correlation between the use of artificial intelligence tools and critical thinking is strongly

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negative ($r = -0,68$), which suggests that greater reliance on artificial intelligence tools is associated with a decline in critical thinking skills [1].

That is why critical and analytical thinking is no longer an additional soft competence for a modern manager, it is no longer a “soft skill”, but a “hard requirement” for every leader. It is a basic condition of his professional activity. Critical thinking is an intellectually disciplined process of active and skillful comprehension, application, analysis, synthesis and/or evaluation of information collected or generated through observation, experience, reflection, reasoning or communication, as a guide to conviction and action [2].

And, fundamentally, it supports human control: technology can help, but cannot replace responsible judgment. The urgency of the problem is enhanced by the fact that the digital environment creates specific threats to management systems. These include disinformation campaigns and deliberate manipulation of public opinion. Added to this is the risk of uncritical use of AI solutions, when a ready-made conclusion or forecast is perceived as truth only because it looks convincing and is presented in a “scientific form.”

For a manager, this means the need to combine two interrelated competencies. The first is the critical analysis of information and arguments. The second is the willingness to act within the framework of a human-centric approach to digitalization, where technology supports decision-making but does not replace responsibility. This is why the development of critical thinking in the training of future managers becomes a systemic challenge for university education.

2. Literature overview

Many works by leading scientists are devoted to the development of cognitive skills, in particular, critical thinking of students, which confirms the importance of this problem in modern times, where the emphasis is shifting from technological development to the expert environment according to the “Human-in-the-Loop” principle.

Models for the formation of cognitive skills of future cybersecurity specialists are described in [3–5]. An analysis of the phenomenon of information vulnerability of the Armed Forces of Ukraine is presented in [6]. The authors argue that an element of defense capability is not only the technical equipment of the army, but also mental readiness to confront information and psychological challenges.

Interesting developments were proposed by the authors of [7]. In their opinion, the formation of the ability of young people to resist information influences should be carried out during their studies in educational institutions of different levels. This competence is developed through the ability to responsibly treat the consumption of information content, counteract destructive influences based on emotional coloring (psychological manipulation, propaganda, disinformation), verify media products for their critical evaluation, and protect one’s own information space.

Our study is closely related to the results of [8]. The author examines the properties of critical thinking in the post-truth era. The post-truth era (the word was introduced in 2016 by the Oxford Dictionary) is a condition in which objective facts have less influence on the formation of public opinion than appeals to emotions and personal beliefs. This confirms that an important component of critical thinking is information hygiene and media literacy.

Cognitive independent activity begins with feelings, and then a transition to thinking can occur. However, any, even the most developed, thinking always maintains a connection with sensory cognition, that is, with the corresponding feelings, perception, imagination. All material for mental activity is received only from one source - sensory cognition. In this context, the analysis of the potential of educational disciplines that form the skills of mediation, non-violent communication and conflict management is promising [9–11]. They are usually associated with the development of socio-emotional competencies. But their internal logic is different, deeper. It involves intensive work with argumentation, interests, assumptions and interpretations. And this creates a natural environment for the development of critical thinking.

Although higher education has considerable experience, there are still many unresolved problems in this area of education. The importance of critical thinking is recognized by almost everyone, but holistic educational solutions are not often found. As a rule, the development of critical thinking is described as a “side effect” of individual disciplines or as a general declaration in educational programs. In particular, the same educational programs for the development of a student’s critical thinking can lead to different results depending on the discipline and the time of exposure [12].

Instead, there is a lack of logic for formation, measurement tools, and connection with real management situations. This is especially evident in topics where it is necessary to distinguish positions and interests, identify hidden motives, and verify interpretations, rather than relying on first impressions. Where it is necessary to build a well-founded position in conditions of tension and uncertainty. This raises a scientifically and practically significant question: can a discipline focused on nonviolent communication skills become an empirically confirmed basis for the formation of critical thinking in future managers? And can it be used to design the next, specifically digital training module that combines critical thinking, responsible decision-making, and leadership in the context of digital risks and the use of AI?

It is the answer to this question that defines the research problem. It is necessary to scientifically substantiate and empirically support such an approach to training managers, where critical thinking is considered as a condition for the information sustainability of the organization, responsible managerial judgment and human-centered use of digital technologies. This, in turn, creates the basis for a new type of educational solutions. Solutions that combine the European normative and value framework of the digital transition, practice-oriented decision-making scenarios and measurable educational results.

Digital transformation in the European Union is changing not only governance tools but also the cognitive “architecture” of governance: what to consider as reliable evidence, how to test arguments, how to make decisions in the face of rapid change and competing information signals. The EU policy framework emphasizes that digital development should empower citizens and businesses while being consistent with European values and fundamental rights, precisely as a principle of a human-centric digital transition [13]. In this logic, education is seen as a key tool for preparing people for action in a digital society. The Digital Education Action Plan (2021-2027) in the format of a communication from the European Commission notes the need to adapt education and training systems to develop the knowledge, skills and competences needed in a digital environment, including the responsible use of digital technologies [14]. Importantly, the focus shifts from purely technical mastery of tools to the formation of digital thinking and the ability to act reasonably in complex socio-management contexts.

A separate layer of sources forms the ethical and legal dimension of the use of artificial intelligence. The Ethics Guidelines for Trustworthy AI emphasize the principle of human agency and oversight: AI should support human autonomy and not replace human judgment [15]. The normative consolidation of the risk-based approach occurs through the Artificial Intelligence Act, which defines the requirements for high-risk AI systems and reinforces the importance of human control as a mechanism for managing risks to rights and security [16]. For management education, this means a practical challenge: the future manager must be able to work with AI prompts as a source that requires verification, explanation and responsible inclusion in the decision-making process, and not as a “final answer”..

In parallel with the regulatory framework, analytics of changes in the structure of demand for skills are developing. The OECD focuses on skills preparation for the digital transition and policies that support adaptation to technological shifts [17]. Analytical materials from the McKinsey Global Institute show that the accelerated implementation of AI and automation is changing the content of tasks and increasing the need for upskilling. The response to this is systemic skills development programs and cooperation between education, employers and institutions [18, 19]. In a similar vein, corporate reviews of the future of the workforce also emphasize the importance of combining cognitive, communicative, and managerial competencies in an environment of technological

uncertainty [20]. Taken together, these sources reinforce our thesis that management education programs should teach not only to “use technology,” but also to support the quality of judgment, that is, to test, argue, and compare alternatives and risks.

At the same time, the literature on the assessment of critical thinking in higher education records the problem of operationalization: the competence is widely declared, but its systematic measurement and coordination of assessment practices at the institutional and policy levels is a difficult task. OECD Education Working Paper No. 293 analyzes policies and practices for the assessment of creative and critical thinking in OECD countries and points to the need for harmonization of tools and the creation of monitoring and evaluation strategies as conditions for the transition from declarations to more sustainable practices [21]. A tangential methodological line in OECD documents also emphasizes the need for professional support for teachers and the design of teaching so that critical thinking is the subject of purposeful development, rather than a side effect of individual topics [22].

For Ukraine, these arguments are of particular importance in the context of digital transformation and European integration processes. The Strategy for the Development of Higher Education for 2022–2032 emphasizes the need to develop critical thinking and the ability of graduates to act in situations of social and technological challenges [23]. This creates the basis for the development of an interdisciplinary educational solution that is both based on the European normative and value model of human-centered digital transition and focused on achieving measurable learning outcomes.

The analysis of the reviewed sources provides grounds for concluding that a new format of educational module is needed. It should integrate European policies and regulations on digital transition and artificial intelligence, develop digital thinking and critical judgment as a tool for maintaining human responsibility, develop leadership and decision-making skills in a complex digital environment, and provide assessment mechanisms that allow empirical confirmation of educational outcomes.

3. Research methods

The study was carried out within the framework of an applied analysis aimed at identifying the connection between the mastery of the elective discipline “The Art of Managing Emotions and Conflicts” and the level of critical thinking among higher education students. The discipline was developed and tested within the framework of the EU Erasmus+ project “Peace Education for Consolidated and Human-Centered Europe” (Grant Agreement No. 101094420 – PeaECH). The methodology for training student managers was based on a practice-oriented approach with the introduction of information and communication technologies as the basis for critical thinking in a digital environment (Table 1).

Initially, this discipline was positioned as a tool for forming a culture of nonviolent communication, empathetic leadership, and constructive conflict management. At the same time, in the process of its implementation, a broader educational effect was recorded, which required separate empirical verification.

Methodologically, the study is structured as a quasi-experimental comparative study in real conditions of the educational process. This design was chosen deliberately, since in the university environment it is impossible to ensure complete randomization of participants without violating the logic of educational programs and the choice of disciplines. Therefore, the study does not claim to establish strict cause-and-effect relationships, but allows us to identify statistically and meaningfully significant associations between educational impact and measurement results.

Two groups of applicants participated in the study. The experimental group (E) consisted of students of various specialties who chose and mastered the discipline “The Art of Managing Emotions and Conflicts”. The control group (C) was formed by students of the specialty “Management”, who at the time of the study did not yet have access to elective disciplines within their educational program.

Table 1.

Information and communication technologies for the development of non-violent communication skills in managers [10]

##	Technology	Name of the area
1.	Virtual simulations and exercises	Simulations of real-life scenarios: Creating virtual situations where managers can practice non-violent communication in conflict situations. This can be a simulation of negotiations or resolving internal conflicts in an organization. Interactive simulators: Software that allows managers to interact with virtual characters that model different types of behavior, requiring appropriate responses. Video lectures: Creation of video lectures series on the principles of non-violent communication, including practical examples and case studies
2.	Online-courses and webinars	Webinars with experts: Holding regular webinars where invited experts share their knowledge and experience in the field of nonviolent communication. Apps for self-reflection: Development of mobile applications that help managers analyze their communication styles and receive recommendations on how to improve them
3.	Mobile apps	Daily reminders and practices: Apps that provide managers with daily exercises or reminders about the principles of nonviolent communication Communal practice: Platforms for sharing experiences between managers where they can discuss real-life situations and get feedback from their peers
4.	Online-communities and forums	Discussions moderation: Using ICTs to create a secure environment where participants can learn how to have constructive discussions focused on a non-violent approach. Assessment of communication skills: Developing online tests to assess the level of non-violent communication skills of managers. Test results can be used for further individualized training.
5.	Interactive tests and evaluations	Multiple-choice scenarios: Interactive tests where managers choose reactions to different scenarios, followed by an analysis of the consequences of the chosen actions VR-trainings: Using VR technologies to create fully immersive environments where managers can practice non-violent communication in conditions as close to real life as possible
6.	Virtual reality (VR)	Empathic immersions: VR scenarios that allow managers to put themselves in the shoes of another person, helping to develop empathy. AI coaching: Using AI to provide personalized recommendations and real-time feedback during training sessions
7.	Artificial intelligence (AI) and chat-bots	Chatbots for training: Creating chatbots that can model conflict situations and help managers practice non-violent communication

The absence of this discipline in the experience of the control group is due to the structural features of the curriculum, and not to the level of motivation or individual choice, which allows us to consider it as a valid group for comparison. To ensure the correctness of the comparison, a paired approach to data selection was used. Only those respondents who passed both the initial measurement and the final testing were included in the final calculations. The comparison was

carried out by email address, which allowed to avoid duplication of responses and incomplete pairs. Repeated fillings were processed according to a single rule: the first answer was taken into account in the initial questionnaire, and the last in the final one. The final paired samples were 14 people in the control group and 18 people in the experimental group.

Data collection was carried out using two different, but methodologically complementary tools. At the entrance, a self-assessment questionnaire of critical thinking was used, developed by Dementievskaya in [24] within the framework of the program for developing critical thinking skills in evaluating Internet resources. This tool allows you to record the dispositional level of working with information and covers four criteria: the attitude to verify sources, the ability to determine the reliability of sources and data, the ability to form one's own opinion and the clarity of its expression [23]. The assessment was carried out on a four-level scale from low to very high. The objective test of critical thinking by Starkey in Lutsenko's adaptation, presented in the Voronov teaching manual [24], was used as the output. The test is a standardized single-factor instrument that meets the basic psychometric requirements of reliability, discriminativeness, and validity. It consists of 27 multiple-choice tasks and allows obtaining an integral indicator of critical thinking, which is interpreted according to normative levels for an adult sample, taking into account gender. This combination of instruments made it possible to distinguish between subjective self-perception of information work practices and objectively measured results of critical thinking. It is this difference between attitudes and actual cognitive operations that is of particular analytical value in the context of management education.

Within the framework of this study, the analytical focus is on testing whether mastering the discipline, in particular its mediation module and the topic of working with interests, is associated with a more favorable profile of critical thinking compared to the group that did not have access to such educational influence. The results obtained are considered not as a universal generalization, but as an empirically sound basis for further designing educational solutions focused on the development of critical thinking, responsible decision-making and the human-centered use of digital technologies in management practice.

4. Main material

The study was aimed at comparing critical thinking indicators in two groups of higher education applicants: a control group of students majoring in Management (C, $n=14$), who did not take the elective subject, and an experimental group of students from different majors (E, $n=18$), who mastered the subject "The Art of Managing Emotions and Conflicts" from the university's catalog of elective subjects. All results are presented for paired samples formed on the principle of matching input and output measurements.

At the first stage, critical thinking self-assessment questionnaires were used before studying the discipline. The results of the initial self-assessment allowed us to record the initial profile of information work practices in both groups and to identify both strengths and structural areas of development. According to the criterion of attitudes towards checking sources and information (Table 2), the majority of respondents in both groups assessed themselves at a high or very high level.

In the control group, this figure was 92.86% (13 out of 14), in the experimental group – 83.33% (15 out of 18). Thus, at the level of the declared attitude, no significant differences between the groups were recorded. This indicates that the attitude itself to the need to verify information is generally formed independently of participation in the discipline and, most likely, reflects the broader educational and social context, rather than the influence of a separate educational course.

At the same time, a clearer difference was observed according to the criterion of determining the reliability of sources and data (Table 3), which reveals an important distinction between declarative readiness and operational ability to work with information.

Table 2.

Input testing (self-assessment):

Criteria – attitude to checking sources and information

Group (Quantity)	Low (1)		Medium (2)		High (3)		Very high (4)	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%
C (14)	0	0.00	1	7.14	6	42.86	7	50.00
E (18)	1	5.56	2	11.11	8	44.44	7	38.89

Table 3.

Input testing (self-assessment):

Criteria – determination of the reliability of sources and data

Group (Quantity)	Low (1)		Medium (2)		High (3)		Very high (4)	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%
C (14)	0	0.00	1	7.14	7	50.00	6	42.86
E (18)	2	11.11	5	27.78	9	50.00	2	11.11

In the control group, 92.86% of respondents (13 out of 14) demonstrated a high or very high level. In the experimental group, this indicator was lower and amounted to 61.11% (11 out of 18), while 27.78% (5 out of 18) assessed themselves at an average level, and 11.11% (2 out of 18) - at a low level. Thus, some students in the experimental group show a gap between the general attitude towards checking information and specific strategies for assessing its reliability, which is critically important in the digital environment. This indicates the need for more systematic development of skills for assessing the quality of sources and data.

According to the criterion of forming one's own opinion (Table 4), the average level dominated in both groups.

Table 4.

Input testing (self-assessment):

Criteria – formation of one's own opinion.

Group (Quantity)	Low (1)		Medium (2)		High (3)		Very high (4)	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%
C (14)	0	0.00	7	50.00	4	28.57	3	21.43
E (18)	0	0.00	12	66.67	5	27.78	1	5.56

In the control group it was 50.00% (7 out of 14), in the experimental group – 66.67% (12 out of 18). This indicates that even with the presence of basic skills of checking information, the formation of one's own reasoned position remains a difficult cognitive task for most of the study participants. The share of high and very high levels in the two groups was comparable, which allows us to consider the formation of a reasoned position as a common area of development regardless of participation in the discipline.

It is worth noting separately the results according to the criterion of expressing an opinion (Table 5).

Table 5.

Input testing (self-assessment):

Criteria – expression of opinion (content and clarity of sources and information)

Group (Quantity)	Low (1)		Medium (2)		High (3)		Very high (4)	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%
C (14)	3	21.43	2	14.29	5	35.71	4	28.57
E (18)	1	5.56	7	38.89	6	33.33	4	22.22

In the control group of managers, a low level was recorded in 21.43% of respondents (3 out of 14). In the experimental group, the share of low levels is significantly lower – 5.56% (1 out of 18), but at the same time, a high share of average levels remains – 38.89% (7 out of 18). This is of fundamental importance for managerial training, since the ability to clearly formulate conclusions, argue a position and communicate decisions is not an auxiliary, but a basic component of a manager's professional activity.

When forming the control and experimental groups, it was assumed that the level of skill development in both groups should be, if not the same, then close.

At the ascertaining stage, the homogeneity of the experimental and control groups in all parameters (Tables 1-4) was checked using the Pearson χ^2 criterion. For this, the formula was used:

$$\chi^2_{emp} = \frac{1}{n_1, n_2} \sum_{i=1}^4 \frac{(n_1 Q_{2i} - n_2 Q_{1i})^2}{Q_{1i} + Q_{2i}}$$

where: n_1, n_2 is the number of students in each group;

Q_{1i}, Q_{2i} is the frequency of the i -th feature in each group;

i is the number of features ($i = \overline{1, 4}$) low, medium, high, very high.

The hypotheses formed were as follows:

H_0 : The differences between the levels of digital skills are not significant and the distribution refers to the same general population.

H_1 : The differences between the levels are significant and are associated with a small sample size.

For each combination of E-C of the i -th feature ($i = \overline{1, 4}$) χ^2_{emp} was found. The results are presented in the table (Table 6). Taking into account the right-hand critical region, i.e. when $\chi^2_{emp} < \chi^2_{cr}$, the hypothesis H_0 is confirmed.

Table 6.Comparison of calculated χ^2_{emp} i χ^2_{cr}

Criteria	χ^2_{emp}	$\chi^2_{cr}(3; 0,05)$	Significance
Setting to check sources and information	1,14	7,815	The difference between groups is not significant
Determining the reliability of sources and data	6,52	7,815	The difference between groups is not significant
Forming one's own opinion	2,1	7,815	The difference between groups is not significant
Expressing an opinion	3,65	7,815	The difference between groups is not significant

Therefore, the differences between the experimental and control groups at the initial stage are statistically insignificant.

Overall, the results of the initial self-assessment show that both groups start with relatively high confidence in their own information practices.

The final assessment was carried out using the standardized Starkey Critical Thinking Test adapted by Lutsenko [25]. Analysis of the distribution of levels showed a different profile of results in the two groups (Table 7).

Table 7.

Output testing (according to norms): Test Starkey/Lutsenko

Group (Quantity)	Low (1)		Medium (2)		High (3)		Very high (4)		Group (Quantity)	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
C (14)	0	0.00	0	0.00	5	35.71	6	42.86	3	21.43
E (18)	0	0.00	0	0.00	3	16.67	5	27.78	10	55.55

In the control group, the results were distributed as follows: average level – 35.71% (5 out of 14), high – 42.86% (6 out of 14), very high – 21.43% (3 out of 14). No respondents with a low or very low level were recorded. In the experimental group, the distribution was different: average level – 16.67% (3 out of 18), high – 27.78% (5 out of 18), very high – 55.55% (10 out of 18). As in the control group, no low levels were found. If we combine high and very high levels, then in the experimental group 83.33% of respondents (15 out of 18) achieved such results, while in the control group – 64.29% (9 out of 14). The largest difference between the groups was observed in the share of very high levels of critical thinking.

Let us check the effectiveness of this technique using statistical methods [26].

The following comparison (Table 8) provides the distribution of previous results in points (the maximum score is 27):

Table 8.

Distribution of results in points

Points	26	25	24	23	22	21	20	19	18	16	15	14	13	8	Total
Group															
E	3	1	2	5	2	2		1	1	1					18
C			1	1	2	1	2	1	1		1	2	1	1	14

To determine the difference between the two groups in terms of critical thinking, we will apply Rosenbaum's *Q*-criterion, since the number of students in each group is at least 11.

The hypotheses formed were as follows:

H_0 : Students in the experimental group do not outperform students in the control group in terms of critical thinking.

H_1 : Students in the experimental group outperform students in the control group in terms of critical thinking.

Sort the values separately in each sample in ascending order. We consider the first sample of the experimental group, because the value in it is higher than in the control group.

$S_1 = 4$ is the number of values that are higher in the experimental group (than the highest value in the control group);

$S_2=5$ is the number of values that are lower in the control group (than the lowest value in the experimental group).

$$Q_{emp}=4+5=9, \quad Q_{cr}(18,14)=7 \text{ at } a=0,05$$

Since, H_0 is rejected (right-sided critical region), i.e., students in the experimental group outperform students in the control group in terms of critical thinking.

To confirm these results, we will apply the Mann-Whitney U-test.

The hypotheses formed were as follows: H_0 of critical thinking in the control group is not lower than the level of critical thinking in the experimental group. H_1 of critical thinking in the control group is lower than the level of critical thinking in the experimental group.

The smallest value is given a rank of one, if the values are the same, then each is given a rank as the arithmetic mean of the subsequent ranks.

The sum of the ranks of the experimental group is 374.5, and in the control group - 153.5.

$$\text{Verification } 374,5+153,5=\frac{32 \cdot 33}{2}=528$$

$$U_{emp}=(n_1 \cdot n_2)+\frac{n_x(n_x+1)}{2}-T_x,$$

where n_1 is the number of students in the experimental group; n_2 is the number of students in the control group; n_x is the number of students in the group with the higher amount; T_x is the larger of the two rank sums.

$$U_{emp}=18 \cdot 14+\frac{18 \cdot 19}{2}-374,5=48,5,$$

$$U_{cr}=\begin{cases} 82, a=0,05, \\ 65, a=0,01. \end{cases}$$

$U_{emp} < U_{cr}$, therefore, the hypothesis H_1 (left-sided critical area) is accepted, i.e. the level of critical thinking in the control group is lower than the level of critical thinking in the experimental group.

The combination of these results indicates a gap between the subjective assessment of readiness to work with information and the objectively measured level of critical thinking. Participation in the discipline is associated with higher scores on a standardized test even with lower starting self-esteem. This allows us to consider the discipline not only as a tool for developing communicative and mediation skills, but also as an educational factor associated with the formation of applied critical thinking relevant to the modern digital environment.

The results obtained are consistent with the working assumption of the study that the discipline, initially developed as a tool for developing skills in nonviolent interaction and mediation, can have an additional educational effect in the area of critical thinking. The mediation module seems to be particularly promising in this sense, in particular the topic of working with interests, which requires applicants to move from positions to the grounds for judgments, verify arguments, identify cognitive distortions and build well-founded conclusions. This result has applied significance for management education. In the digital environment, the influence of information manipulation is increasing, verification of sources is becoming more difficult, and the requirements for informed decision-making are increasing. The discrepancy between the initial self-assessment and the results of objective testing recorded in the study additionally indicates that the declared readiness to verify information is not always transformed into a measurable result without targeted educational impact. In this context, the data obtained create the basis for further designing a more targeted educational component focused on the development of critical thinking in the digital environment and the responsible use of artificial intelligence tools in management practice.

5. Conclusions

The obtained data indicate an important trend for the modern system of higher education. The declared readiness to work with information is not identical to the formation of critical thinking as a practical cognitive ability. Within the framework of the study, this was manifested in the discrepancy between subjective assessments of one's own information practices and the results of standardized critical thinking testing. In both groups, participants already at the initial stage demonstrated confidence in their ability to check data and sources. However, objective results have shown that these beliefs are not always accompanied by sufficiently developed skills of analysis, argumentation and assessment of the reliability of information. This observation is consistent with the conclusions of analytical reviews of the OECD, which emphasize that critical thinking in university education is often considered as a normative value, but rarely appears as a systematically formed and measured competence [21]. At the same time, the results of this study clarify the problem: it is not only about the lack of assessment tools, but also about the limitations of self-assessment as an indicator of real cognitive readiness to act in conditions of information complexity.

It is worth noting that at the beginning of the study, students in the control group of the Management major demonstrated higher confidence in their ability to verify information compared to participants in the experimental group. However, the final standardized testing showed that it was the experimental group that achieved a higher level of critical thinking. This confirms that critical thinking does not arise automatically within the framework of professionally oriented training and is not a direct result of academic socialization. As noted in [22], its development requires specially created learning situations where students work with argumentation, assumptions and alternative interpretations, and not only with searching and checking sources.

In this context, the results of the study allow us to reassess the educational potential of the discipline "The Art of Managing Emotions and Conflicts". Although it was originally developed as a tool for forming a culture of non-violent interaction and mediation, its didactic structure turns out to be relevant for the development of critical thinking. Working with interests in the mediation process requires students to move from positions to justifications, verify arguments, identify hidden assumptions and compare alternative explanations. It is these cognitive actions that form the basis of critical thinking and can explain the higher results of the experimental group on an objective test.

In the broader perspective of the digital transformation of management, the results obtained acquire additional significance. European documents related to digital education and the regulation of artificial intelligence emphasize the importance of maintaining human control and responsibility for decisions made in conditions of algorithmic support [14, 16]. In this context, critical thinking goes beyond the boundaries of purely academic competence and increasingly appears as a component of the professional and information security of a manager. For management education, this is of particular importance, because a manager interacts not only with data, but also with people, conflicts, emotional reactions and digital communications, where the risk of manipulation and distortion increases. The ability to critically analyze messages, arguments and sources becomes a prerequisite not only for effective management decisions, but also for the sustainability of an organization in an information-rich environment.

At the same time, the interpretation of the study results requires taking into account its limitations. The small sample size and heterogeneity of specialties in the experimental group do not provide grounds for strict cause-and-effect conclusions. However, the differences found are consistent enough to be considered as an empirical basis for further research and for the development of educational components specifically aimed at developing critical thinking in a digital management environment.

Declaration on Generative AI

While preparing this work, the authors used the AI programs Grammarly Pro to correct text grammar and Strike Plagiarism to search for possible plagiarism. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

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