European Journal of Contemporary Education
E-ISSN 2305-6746
2026. 15(1): 66-75
DOI: 10.13187/ejced.2026.1.66
https://ejce.cherkasgu.press

Validation of the Critical Thinking Questionnaire (CThQ) in a Sample of Students from Vocational Secondary Schools in Slovakia

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Abstract

Critical thinking is a core priority of modern education, yet its effective support in schools continues to pose significant challenges. The aim of this study was to identify, through students' self-assessment, the attributes of critical thinking in which students would welcome teacher support during instruction. The study was conducted on a sample of 104 final-year students from Slovak vocational secondary schools, with the *Critical Thinking Questionnaire (CThQ)* as the primary data collection tool. The results indicate that students most frequently identify memory as a significant weakness, which may limit the development of higher-order critical thinking skills such as analysis, evaluation, and creation. Based on these findings, we recommend placing greater emphasis on supporting memory processes and linking them to the application of acquired knowledge in more complex cognitive operations. Furthermore, our analysis suggests that aligning students' and teachers' perceptions of learning needs represents a key factor for the effective development of critical thinking in the educational process.

Keywords: critical thinking, student support, memory, self-assessment, knowledge.

1. Introduction

In today's educational environment, developing critical thinking is one of the primary goals of school teaching and curricula. Critical thinking is the ability to objectively analyze information, evaluate its credibility, formulate independent conclusions, and create solutions based on evidence. Its development is essential not only for students' academic success but also for their future active participation in social and civic life (Facione, 2011). Well-developed critical thinking is necessary for

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young people to face the challenges of the 21st century, such as misinformation, societal polarization, and a rapidly changing job market (Abrami et al., 2015). Purposeful cultivation of these skills in education contributes to forming autonomous citizens capable of making their own decisions.

Although critical thinking development is often declared a priority of educational systems, reliably measuring it is challenging because it is a complex, multidimensional construct. The concept encompasses various cognitive and metacognitive processes, from simple recall of information to evaluation and creative application. A suitable framework for its analysis is offered by Bloom's taxonomy of cognitive objectives, which includes levels such as remembering, understanding, applying, analyzing, evaluating, and creating (Krathwohl, 2002).

To measure students' critical thinking, two main types of tools are used: performance-based tests and self-assessment questionnaires (Ku, 2009; Liu et al., 2014). Performance-based tests, such as the California Critical Thinking Skills Test (CCTST), measure actual cognitive skills like analysis, deduction, interpretation, or evaluation of evidence (Facione, 2011). Self-assessment questionnaires measure students' perception of their abilities – how they perceive and evaluate their skills in areas such as understanding, analysis, or creation (Stupple et al., 2017). Their advantages include easier administration, lower time demands, and the ability to capture attitudes, motivation, and self-confidence related to critical thinking (Vafamehr et al., 2024).

An important aspect of examining critical thinking is not only objective measurement of students' outputs but also the perspective of teachers who lead and guide the learning process. Teachers play a key role in the development of critical thinking, as their expectations, assessments, and teaching methods significantly influence the types of cognitive activities students engage in (Ennis, 2018). If teachers perceive certain areas as strong or weak, it translates into teaching priorities and instructional decisions. Discrepancies may occur between teachers' perceptions of students' abilities and the actual skills students possess (Gentrup et al., 2020). Such a mismatch between teacher evaluations and students' self-assessments can undermine the effectiveness of instruction. When a teacher offers support in areas that students do not consider challenging, the assistance is unlikely to be perceived as relevant or beneficial. Rather than enhancing learning, this may result in reduced engagement and lower intrinsic motivation to learn (Kruger, Dunning, 1999). The aim of this study was to validate the Critical Thinking Questionnaire (CThQ) on a sample of students from vocational secondary schools in Slovakia. After validating the questionnaire, another aim was to identify in which of the assessed areas of critical thinking students from vocational secondary schools feel the least developed based on their self-assessment. The research results may provide important insights for educational practice, particularly in enhancing teaching strategies focused on the development of critical thinking in line with students' individual needs.

2. Literature Review

The concept of critical thinking has undergone significant theoretical development in recent decades, resulting in various definitional approaches. In academic settings, critical thinking is often defined as the ability to objectively analyze information, assess its trustworthiness, form independent judgments, and generate evidence-based solutions (e.g. Scriven, Paul, 1987; Facione, 1990). This foundational framework has been extended to include dimensions of reasoned decision-making. Norris (1985), for instance, defined critical thinking as the reasonable determination of what to do or believe. Another important contribution comes from Elder and Paul (1994), who emphasized personal responsibility for one's own thinking. Their concept moves critical thinking from a purely cognitive level to the level of metacognitive self-reflection, where individuals become responsible for the quality of their thought processes. Scriven and Paul (1987) expanded this understanding by incorporating operational components, defining critical thinking as an intellectual process involving conceptualization, analysis, synthesis, and evaluation of information.

Further development of the concept introduced creativity into the equation. According to Temple et al. (1998), critical thinking is a complex process of creative integration of thoughts and information, a restructuring of concepts. It is an active and interactive cognitive process that occurs simultaneously on multiple levels, typically goal-oriented but also creatively improvised. This definition underscores the active and interactive nature of critical thinking, going beyond passive information processing to include creative reconsideration of existing conceptual frameworks.

Further research (Klooster, 2002) identified five core attributes of critical thinking that form its operational basis. The first is independent thinking, enabling individuals to formulate their own

opinions regardless of external pressure. The second is understanding information as a starting point, not an endpoint, of thinking. The third emphasizes that critical thinking begins with asking questions or posing problems, highlighting an active approach to knowledge, where the thinker is not a passive recipient but an active and creative problem-solver. The fourth is seeking logical arguments that ensure rational decision-making. The fifth sees critical thinking as a social process, recognizing its collaborative dimension. As Facione (2011) states, these attributes are essential not only for civic and societal engagement but also for academic success during students' schooling.

Incorporating critical thinking development into teaching is essential for practical education. Strong critical thinking enhances students' problem-solving, evidence-based decision-making, academic independence, and ability to navigate an information-rich environment (Abrami et al., 2015). As Davies (2015) highlights, classrooms that actively promote critical thinking foster deeper understanding, greater engagement, and better readiness for challenges beyond school.

Klooster's (2002) identified attributes provide a foundational framework for teaching that supports the development of critical thinking. Within this framework, the latest information or problem-solving should be seen as a starting point for new knowledge. The information or problem should spark curiosity, prompting students to ask questions that lead to reflection and discussion. This approach fosters a dynamic learning environment where learning becomes a process of discovery and knowledge construction. Critically thinking students value others' claims and arguments, but they are not afraid to reject them if they deem them incorrect (Dwyer et al., 2014). A major benefit of teaching based on critical thinking attributes is that students learn not only how to process the latest information and methods for solving problems but also how to argue and creatively express and present their own opinions and problem-solving strategies. This aspect of critical thinking development promotes the integration of new knowledge with existing knowledge. Students also become more cautious in forming or changing their judgments (Facione, 1990).

Thus, a key element in developing critical thinking is the ability to seek evidence and make decisions based on it. This approach cultivates students' epistemological responsibility and teaches them to distinguish between credible and non-credible information sources (Holmes et al., 2017). Given the range of critical thinking attributes, its development in the school environment requires systematic use of specific methodological approaches. Classroom activities should include argument analysis, identification of logical fallacies, and evaluation of the quality of evidence (Rossi et al., 2021). These activities help students learn constructive problem-solving, including the ability to reason, discuss, compromise, and accept solutions. A crucial precondition for success is an active student who has mastered basic facts and can assess latest information, engage in discussions, and form independent judgments (Tang et al., 2020).

The extent of student engagement is significantly influenced by the teacher through interactions, teaching strategies, and classroom atmosphere (Shernoff et al., 2017; Hanaysha et al., 2023). However, according to Rahman and Manaf (2017), teachers' efforts to involve students in lessons often result in lowering demands on higher-order cognitive levels when students struggle with lower levels, leading to a preference for memorization over the intentional development of critical thinking.

Another possible cause of the low effectiveness of critical thinking development in the school environment may lie in the complex and multidimensional nature of the concept of "critical thinking" itself. Successful development of critical thinking therefore requires systematic and balanced reinforcement of its multiple dimensions, and any didactic intervention should be based on the real needs of specific students (van Geel et al., 2016). An important element in this process can be the student's own self-reflection. When a student identifies a specific area of critical thinking, such as information analysis or argumentation, in which their skills are weaker than in other areas, it creates an opportunity for intrinsic motivation to improve. In such situations, the student is more likely to view the teacher's support as necessary and helpful, responding to a need they have personally recognized. At this stage, acceptance of guidance is natural, as it is grounded in an internally acknowledged gap (van Uden et al., 2013). On this foundation, the teacher can then, by utilizing the student's increased engagement, purposefully and gradually develop other attributes of critical thinking that they consider important for the student's overall intellectual and academic development. Such an approach connects student autonomy with strategic guidance from the teacher, creating favorable conditions for deeper learning and the development of higher-order cognitive skills (Hadwin et al., 2017). Based on the above, it is clear that effective support for the development of critical thinking must be based not only on the

teacher's professional intentions but also on the students' real needs as perceived by the students themselves. If didactic intervention is to be targeted and accepted, it is essential to identify the areas of critical thinking in which students themselves feel a need for development and what kind of help they would welcome from their teachers. Aligning the perceptions of needs between students and teachers can be the key to more effective and targeted support of higher cognitive processes in the classroom.

3. Methodology

The educational research was carried out in selected vocational secondary schools in Slovakia with the approval of school management, teachers, and participating students. Schools whose management provided preliminary consent were listed alphabetically by city, and four were chosen through simple random sampling using the tool randomnumbergenerator.org. All final-year students at the selected schools were invited to participate via their class teachers. A total of 138 students attended an introductory meeting with the research team, during which they were informed about the study and assured of full anonymity. Researchers addressed all questions, ensuring that responses would not influence students' behavior during the actual study. Ultimately, 104 students aged 18 to 20 participated in the research.

To achieve the research goal of identifying areas where students perceive a need for pedagogical support, it was essential to capture their self-assessment of critical thinking. The Critical Thinking Questionnaire (CThQ) by Kobylarek et al. (2022) was used as the primary data collection instrument. Designed as a practical and pedagogically applicable tool, the CThQ evaluates students' perceived cognitive abilities across six domains – memory, understanding, application, analysis, evaluation, and creation – representing the key dimensions of critical thinking in education. The questionnaire allows an overview of students' perceived strengths and weaknesses in higher-order thinking. Each cognitive domain is represented by a set of statements rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), indicating the extent to which each statement reflects the respondent's own behavior or ability.

For analyzing the results, descriptive statistics and factor analysis were applied as the primary statistical methods.

4. Data Analysis

Prior to the main statistical examination of the data collected using the CThQ instrument, the quality of the dataset was evaluated with respect to its reliability and validity. As these two attributes are inherently linked, with sufficient reliability serving as a fundamental prerequisite for valid measurement, the initial focus was placed on assessing the reliability of the collected responses. For this purpose, reliability coefficients were computed. The internal consistency of the questionnaire was assessed using Cronbach's alpha coefficient, which represents a widely accepted measure of test reliability and is routinely implemented in statistical software environments (Liu, Zumbo, 2007). In the present study, the computation performed in the R statistical software yielded a Cronbach's alpha value of 0.843, reflecting a satisfactory level of internal consistency of the measurement instrument. This result suggests a strong interrelationship among the questionnaire items and indicates that the contribution of random measurement error to the overall test score is minimal. Consequently, the obtained value of $\alpha = 0.843$ can be interpreted as evidence of reliable data (Cronbach, 1951).

In the subsequent stage of statistical processing, the dimensional structure of the dataset was explored through the application of principal component analysis in order to identify underlying latent variables. The eigenvalues of the correlation matrix were calculated using the R statistical software. Following Kaiser's criterion, the number of extracted factors corresponds to the count of eigenvalues exceeding the threshold value of one. Eigenvalues satisfying this condition are reported in Table 1.

Table 1 indicates that six eigenvalues of the correlation matrix exceed Kaiser's threshold and together explain 65.123 % of the total variance. Due to the complexity of the initial factor solution, factor rotation was applied to improve interpretability and obtain a simple structure, in which each factor is strongly associated with a limited set of variables. This simplification was achieved using the VARIMAX rotation method (Osborne, 2015), resulting in the factor loading matrix shown in Table 2.

Table 1. Eigenvalues of the Correlation Matrix

Value number	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	5.110	26.935	5.110	26.935
2	3.040	14.997	8.149	41.932
3	1.919	7.686	10.068	49.618
4	1.576	6.099	11.644	55.717
5	1.334	5.335	12.978	61.052
6	1.218	4.071	14.196	65.123

Table 2. Estimation of Factor Saturation Matrix

Factors and items	Factor loading					
	1	2	3	4	5	6
Factor 1: Analyzing						
4. In-depth analyses of reality are a waste of life	**0,52**	-0,13	0,10	0,09	-0,14	0,13
12. I like finding dependencies between seemingly different phenomena	**0,61**	-0,22	0,16	0,12	0,23	-0,04
17. I can extract the most relevant parts of a text	**0,42**	0,08	0,26	-0,09	0,19	0,25
24. When I read the text, I am researching for a relationship between the information it contains and other texts that I have read	**0,78**	0,23	0,03	0,04	0,20	0,11
Factor 2: Evaluating						
1. After reading it, I check important information, even if it seems to be true	-0,14	**0,50**	-0,05	-0,10	0,05	-0,23
11. In the discussion, I care about justifying my stance on the matter and understanding the other party at the same time	0,03	**0,59**	-0,11	0,13	0,08	0,14
16. When I am interested in some information, I try to check if it is true	0,07	**0,49**	-0,15	0,23	0,22	0,16
18. To evaluate the information, I check many sources	0,22	**0,43**	-0,04	0,04	-0,24	0,05
Factor 3: Creating						
2. I like combining information from different texts	0,03	-0,16	**0,41**	0,15	0,06	0,19
6. The same content can be expressed in many different ways	0,09	0,17	**0,48**	-0,19	0,02	0,05
8. I form my impression on the basis of various information that I combine with each other	0,15	-0,23	**0,67**	-0,28	-0,23	-0,13
9. Everything already exists, so nothing completely new can be created	0,16	0,12	**0,52**	-0,06	-0,25	-0,22
13. I can see the structure of the text, and I could change it	0,14	0,07	**0,73**	0,25	-0,15	0,16
20. I like discussing new meanings in texts that I already know	0,02	0,17	**0,68**	0,07	-0,01	-0,15

Factor 4: Remembering						
5.After reading it, I am able to repeat important threads from the text	0,02	-0,19	0,16	**0,55**	0,06	0,19
15. If necessary, I can recall information about which I once read	0,06	-0,26	0,14	**0,61**	0,29	0,02
19. I do not remember much from what I was learning at school	0,07	-0,06	0,16	**0,80**	0,13	-0,27
Factor 5: Understanding						
7. I can understand texts from various fields	0,11	0,03	0,13	-0,12	**0,55**	-0,27
21. I like to collate different opinions and compare them with each other	-0,23	-0,17	0,30	-0,01	**0,58**	0,27
22. I have difficulties with paraphrasing	0,06	0,05	0,05	0,17	**0,47**	-0,11
25. I pay attention to the contexts, nuances and overtones of the statements	-0,07	0,28	-0,09	-0,20	**0,44**	-0,25
Factor 6: Applying						
3. I am willing to share the newly gained information	0,08	0,29	0,01	-0,04	0,00	**0,49**
10. When I talk, I give many examples	-0,16	0,24	0,16	0,08	0,05	**0,76**
14. When discussing, I try to use practical examples to justify my stance on the matter	0,18	0,09	0,02	0,11	0,13	**0,55**
23. I try to use the information I have learned in everyday life	-0,23	0,25	0,23	0,20	0,26	**0,67**
Eigenvalues	5,11	3,04	1,92	1,58	1,33	1,22
% of variance	26,94	15,00	7,69	6,10	5,33	4,07

The factor analysis indicated that the results presented in Table 2 align with the allocation of variables to the respective factors as originally defined by the questionnaire developers. Based on these findings, it can be concluded that the sample of respondents in this study is sufficiently representative. Moreover, the consistent distribution of questionnaire items across factors allows the retention of the original factor names.

Using the data collected through the CThQ questionnaire, the mean score across all items was calculated. The resulting average of 3.05 (on a 1–5 scale) suggests that participants generally perceive their critical thinking abilities as ranging from average to slightly above average.

Subsequently, mean scores were determined for each individual factor (Figure 1). For clarity, the factors were organized in accordance with the revised Bloom's taxonomy (Krathwohl, 2002).

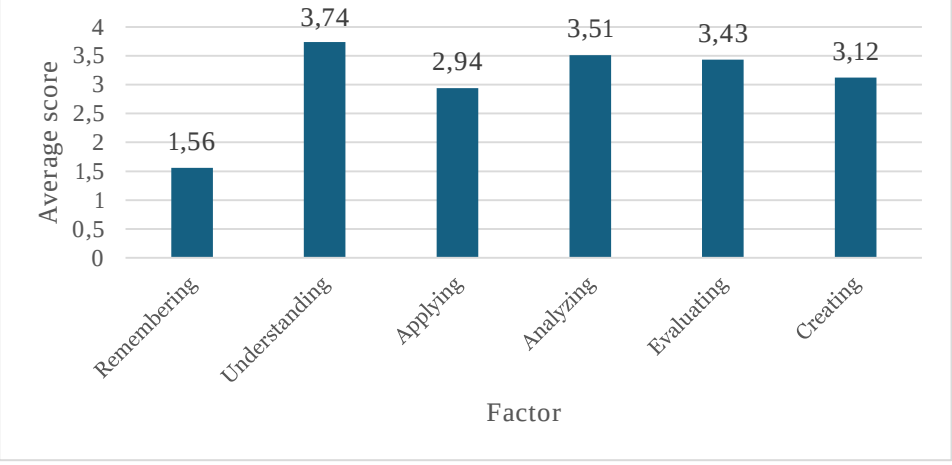

Fig. 1. Average scores in individual dimensions

Figure 1 shows that students achieved the lowest average score in the *Remembering* factor. This very low average score (avg = 1.56) was primarily caused by item 19: *"I do not remember much from what I was learning at school"*, which also had the highest saturation within this factor. The highest average score was achieved in the *Understanding* factor (avg = 3.74), mainly due to item 22: *"I have difficulties with paraphrasing"*, where students scored an average of 4.52.

5. Discussion

In vocational education, the theoretical foundations of critical thinking serve as a driving force for the incorporation of active learning strategies. Effectively fostering critical thinking requires learning activities that actively engage students, enrich their experiences, promote independent knowledge acquisition, develop sound judgment, and encourage responsible behavior. As Kroiče (2015) emphasizes, reflection and self-assessment are central processes that facilitate the development of students' critical thinking skills. These processes allow students not only to evaluate retrospectively their approaches to knowledge and problem-solving but also to recognize their cognitive strengths and weaknesses – an essential prerequisite for metacognitive development and the gradual assumption of responsibility for their own learning.

In the self-assessment questionnaire CThQ, students reached an average score of 3.05. This value lies slightly above the neutral midpoint of the scale, suggesting that students generally perceive their critical thinking skills as average to slightly above average. This means they see themselves as capable of critical thinking, which may positively influence their engagement in education and openness to complex problems.

From a pedagogical perspective, this result should be interpreted with caution. Multiple studies indicate that self-assessments can be biased, particularly among younger or less experienced students who may not have an accurate metacognitive understanding of their abilities. Research by Dunning and Kruger (Kruger, Dunning, 1999) shows that individuals with lower performance often overestimate their skills, resulting in inaccurate self-perceptions. Likewise, Stupple et al. (2017) note that while self-assessment instruments capture important aspects of how thinking is perceived, they may not accurately reflect students' actual performance on tasks that require higher-order cognitive processes.

Considering these findings, it is beneficial to combine subjective self-assessment with deliberate teacher feedback, which can contribute to more accurate student self-knowledge and consequently to more targeted development of specific critical thinking areas. León et al., in their meta-analysis, recommend that teachers explicitly plan and provide external feedback whenever students engage in self-assessment, to correct subconscious biases. Research findings show that teacher support is most effective when provided in areas where the student is aware of their shortcomings (Le Mare, Sohbat, 2002; Jeng, 2024).

The analysis of the collected data, carried out for each dimension of critical thinking according to the revised Bloom's taxonomy, allowed the identification of a specific area of perceived weakness among students. The findings revealed that students considered the Remembering dimension to be their most significant deficiency, with an average score of just 1.56 on a five-point Likert scale. This result clearly reflects a very low level of confidence in this fundamental cognitive domain.

We consider this finding remarkable, as *Remembering* represents the lowest level of cognitive processes within Bloom's taxonomy – it is the ability to recall facts, definitions, procedures, or basic information. The fact that students perceive this particular dimension as problematic is paradoxical, given that this skill is the most strongly emphasized and routinely practiced in traditional school environments (Matsushita, 2017).

This low confidence in the *Remembering* dimension may indicate that students do not sufficiently appreciate the importance of memory for learning. This underestimation may be due to traditional repetitive exercises being perceived as insufficient for deeper understanding and the development of higher-order cognitive abilities (Voogt, Roblin, 2012). Another possible reason for this devaluation may lie in the current educational trend, which increasingly shifts away from so-called "traditional" knowledge reproduction approaches and toward the development of "higher" cognitive skills such as analysis, evaluation, or creativity. In this context, memorization is sometimes seen as less important or even outdated (Maag Merki et al., 2023).

However, the ability to remember facts and information forms a vital foundation for more complex forms of thinking – without an adequate knowledge base, it is impossible to effectively analyze, compare, or generate new connections (Lemov et al., 2016).

Based on our findings, the area of *Remembering* represents a suitable starting point for the systematic support of critical thinking development in students. Since students themselves identified this as their weak spot, targeted teacher support is likely to be seen as relevant and welcomed. The importance of developing this cognitive level is also supported by the fact that low confidence in basic knowledge i.e., the ability to recall and reproduce key facts – can significantly hinder the development of higher cognitive processes such as application, analysis, or evaluation. These higher cognitive processes naturally presuppose certainty in basic knowledge (Acar, van den Ende, 2016).

Therefore, when supporting memorization, teachers should go beyond routine rote learning and aim to integrate memorized information into activities that stimulate higher-order thinking. Effective strategies may include linking facts with conceptual understanding, applying them in problem-solving situations, or using them in constructive discussion. This approach transforms passive knowledge acquisition into active cognitive processing, aligning with the findings of Kane et al. (2004), who emphasize the importance of engaging in higher cognitive skills even when working with factual knowledge.

This suggests that improving memory skills should not be viewed in isolation but rather as part of a broader strategy to develop critical thinking. Exploring effective teaching approaches that enable the transfer from factual knowledge to critical reflection presents a promising direction for future educational research.

6. Conclusion

The results of our research indicate that the development of students' critical thinking should begin with strengthening their confidence in basic cognitive skills, especially in the area of remembering. Students themselves identified this area as their weakness, which highlights the need for targeted teacher support. Effective teaching should not limit work with factual knowledge to rote memorization but should connect it with activities that activate higher-order cognitive processes. Such an approach not only supports students' metacognitive growth but also lays the foundation for deeper understanding and critical thinking. Future research should focus on evaluating specific teaching strategies that enable an effective transition from fact acquisition to the development of critical thinking.

7. Acknowledgments

This work was also supported by the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences under contract No. KEGA 019 ŽU-4/2023.

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