

Critical Thinking Questionnaire (CThQ) – construction and application of critical thinking test tool

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Abstract

Thesis. The article presents the construction process and psychometric properties of *the Critical Thinking Questionnaire (CThQ)*. The questionnaire is a critical thinking test tool designed for adolescents and adults. The basis for creating the questionnaire

was classifying the educational goals proposed by Benjamin Bloom and spread by critical thinking practitioners.

Methods. The independent rater system was used in the construction of the test, while the psychometric properties of the test were tested on a sample of 198 people, calculating the inter-correlation and the Cronbach's Alpha reliability coefficient.

Result. Both assessments of the independent rater system and research checking the psychometric properties of the test indicate high reliability of the tool. Cronbach's Alpha coefficient of internal consistency was 0.87. In its final version, the test consists of 25 items, the results of which allow assessing critical thinking in 6 scales: remembering, understanding, applying, analysing, evaluating, and creating. The tool also allows checking the overall score.

Keywords: key competences, abilities, adult education, critical thinking diagnosis, adulthood, transformative learning

Introduction

Critical thinking is one of the key competences of an adult, which is indispensable both in work and also in private life. The rich andragogical literature very often indicates the need to develop this type of competence while referring to the rich literature on the psychology of adult development (Malewski, 1998). The European Commission has also dealt with this topic multiple times, trying to define a place of critical thinking in the entire constellation/hierarchy of other key competencies (EAEA, 2006). It is even more surprising that there is a lack of appropriate tools to measure this type of ability. The weakness of the existing solutions in this area is, above all, the possibility of quick application and analysis of the results. The problem is also the fact that the best tools, which are commonly used in the world, have no Polish equivalents.

The cause of all these difficulties may be the issue with defining the concept of critical thinking, or at least the lack of agreement on one basic approach to this term (Wasilewska-Kamińska, 2016).

The traditional approach goes back to American pragmatism, the community of inquiry, information evaluation. Other, more extensive theoretical propositions of the concept of critical thinking were suggested by Robert Ennis, Richard Paul, Linda Elder, Harvey Siegel, and Deanna Kuhn.

R. Ennis (1962) equates critical thinking with the correct assessment of statements. It can also be defined as logical, rational, and reflective thinking.

R. Paul and L. Elder (2012) consider critical thinking as analysis, evaluation and improvement. Therefore, critical thinking could be something more than natural reflections, beliefs and judgments.

H. Siegel (1988) associates critical thinking with rationality, understood as effectiveness in achieving goals. He also pays attention to the justification of claims and commitment, which he calls passion. On the other hand, a critical attitude is the ability to evaluate justifications.

D. Kuhn (2008) identifies critical thinking with the art of arguing and defines it as metacognitive competence - the ability to use meta-knowledge - higher-order or more organised knowledge.

In one of the most recent approaches, Jeremy Lamri (2018), referring to the concept of Diane Halpern (1998), indicates 4 types of abilities:

- observation (gathering and analysing arguments),
- identification (generating conclusions),
- accuracy (the ability to weigh arguments),
- choice (the ability to find the right answer to a given problem).

The mentioned concepts lead us to define critical thinking as the ability to assess the reliability/truthfulness of the information. Logical thinking, reflexivity, analytical skills, or evaluation are always about assessing statements in a particular context. In this context, the most appropriate seems to be the reference to the taxonomy of educational goals by B. Bloom (1956) which may be the basis for assessing the reliability of information assessment.

Construction of the questionnaire — content areas, manifestation areas and the scales of responses

The theoretical basis for distinguishing the content areas was the classification of educational goals proposed by Benjamin Bloom, which contains the following areas: remembering, understanding, applying, analysing, evaluating, creating. For individual areas, each researcher (N = 3) independently developed a list of items taking into account the following areas of manifestation: skills, attitudes and behaviours. The list of statements was first internally evaluated. Repeated / similar items as well as items with the lowest scores have been removed. Then, a form was developed (with

definitions of areas (N = 6) (Henzler, 2018) and the assignment of the statements (N = 39) for independent raters (N = 3).

Kendall's W calculated for each item indicates the satisfactory compliance of the independent rater system in assessing the scales (see Tab. 1). The lowest result was obtained for the *Analysing* $W=0,59$ scale (this compliance can be considered as moderate), and the highest compliance occurred when assessing the *Understanding* $W= 0.83$ scale.

Table 1.

Compliance analysis of independent rater system using the Kendall's W test

Subscale	Input number of items	Kendall's W	χ^2	df	p
Analysing	6	0.59	8.89	5	0.113
Evaluating	6	0.72	10.81	5	0.055
Creating	8	0.64	13.38	7	0.063
Remembering	5	0.53	6.40	4	0.171
Understanding	6	0.83	12.50	5	0.029
Applying	6	0.67	10.00	5	0.075
CThQ-overall score	37	0.55	59.37	36	0.008

Source: own research

The Kendall's W was also calculated for all items together $W = 0.55$ which indicates the satisfactory compliance of the independent raters also when assessing for the entire questionnaire.

After determining compliance, the criteria for selecting the statements were calculated (see Tab. 2). Items that did not meet the criteria have been rejected (see Tab. 3).

Table 2.

The criterion for selecting the position in individual scales

Subscale	Input number of items	Σ Sum of ranks	Σ Sum of ranks/number of items (the criterion of the selection of statements)
Analysing	6	63	10.50
Evaluating	6	63	10.50
Creating	8	75	9.38
Remembering	5	45	9.00
Understanding	6	63	10.50
Application	6	63	10.50

Source: own research

Table 3.

Statements rejected as a result of applying the independent rater system

Subscale	Number and sound of rejected statements ^a	The sum of ranks of the statement
Analysing	- <i>I do not like experimenting</i> (reversed)	5.50
Evaluating	- <i>If I agree with the author, I defend their matter</i>	8.50
	- <i>Real knowledge doesn't get old</i> (reversed)	3.50
Creating	- <i>I am able to imagine an alternative course of history</i>	9.00
	- <i>The world offers many opportunities to express ourselves</i>	5.00
Remembering	- <i>I can easily remember the texts that I read</i>	8.00
	- <i>I can name the most important authorities in fields important to me</i>	5.50
Understanding	- <i>Literature and contemporary art are incomprehensible to me</i> (reversed)	3.00
Applying	- <i>I believe that most of the information can be tried to be used in practice</i>	7.50
	- <i>I believe that what works best is what has been proven a long time ago</i> (reversed)	4.50

Source: own research

Finally, (at this stage), the questionnaire contained 27 items, of which individual areas included: Analysing – 5 items, Evaluating – 4 items, Creating – 6 items, Remembering – 3 items, Understanding – 5 items, and Applying – 4 items.

To evaluate individual statements a 5-point Likert scale was used, where 1 meant “strongly disagree”, 5 – “strongly agree”. Respondent’s particulars were the following sociodemographic variables: gender (female, male); age; and education degree.

Tool psychometric properties

Research subjects

198 people participated in the study, including 174 women and 24 men. The average age of the subjects was 29 (M = 29.3, SD = 17.1).

Reliability

The respondents completed a paper-and-pencil questionnaire. Cronbach’s alpha test result for the entire test was $\alpha=0.855$.

As a result of the analysis, due to the negative correlation of one of the loads and a significant reduction in reliability ($r \geq 0.5$ was assumed as the acceptable level of intra-area correlation) of one of the areas by the other load, two items were finally removed (see Tab. 4). The final value of reliability for the entire test was after the correction at the level of 0.877, with the minimum load’s power at the level of $r > 0.86$. The number of qualified statements was 25.

Table 4.

Analysis of Cronbach’s Alpha reliability coefficient

Subscale	Input items	Input Cronbach’s α coefficient	Rejected statements	Input items	Output Cronbach’s α coefficient
Analysing	5	0.467	<i>I think that to explain something, evidence is needed</i>	4	0.568
Evaluating	4	0.712		4	0.712

Creating	6	0.554		6	0.554
Remembering	3	0.608		3	0.608
Understanding	5	0.464	<i>The form of communication has no bearing on the understanding of the information</i>	4	0.574
Applying	4	0.644		4	0.644

Source: own research

Internal relevance

In order to test the internal relevance of the tool, the Pearson's correlation (r) test was used (Tab. 5)

The analysis results indicate positive correlations between the individual scales of the CThQ test in relation to each other and of each of them with the overall score. It is important that the correlations between the scales are much lower than the correlations of the individual scales with the overall score. This proves that the homogeneity of scales and internal consistency of the test are satisfactory.

Table 5.

Internal CThQ (N=198) correlations between individual categories and the overall score.

	1.	2.	3.	4.	5.	6.	7.
1. Analysing							
2. Evaluating	.431***						
3. Creating	.658***	.422***					
4. Remembering	.483***	.442***	.393***				
5. Understandin g	.618***	.440***	.625***	.504***			
6. Applying	.451***	.471***	.447***	.410***	.524***		
7. Overall score	.803***	.712***	.759***	.738***	.816***	.713***	

Notes: *p<0.05, **p<0.01, ***p<0.001

Source: own research

Summarising, it can be stated that both the assessments of the independent rater system and studies checking the psychometric properties of the test indicate high reliability of the tool. In its final version, the test consists of 25 items, the results of which allow assessing critical thinking on 6 scales: remembering, understanding,

applying, analysing, evaluating, and creating. The tool also allows checking the overall score.

Calculation of scores and interpretation

Calculation of the raw score for a single scale

The raw scores for a single test scales are calculated by summing up the scores for all items falling within the scope of that scale.

Calculation of the raw score for the entire test

The raw score for the total test is calculated by summing up the scores for all items in the test.

Depending on the number of points obtained in individual areas, the results can be divided into three groups: high, medium and low (see Tab. 6).

Table 6.

A suggested interpretation of raw scores

		Low results	Average results	High results
1.	Analysing	5-10	11-14	15-20
2.	Evaluating	5-10	11-14	15-20
3.	Creating	6-13	14-22	23-30
4.	Remembering	3-7	8-10	11-15
5.	Understanding	5-10	11-14	15-20
6.	Applying	5-10	11-14	15-20
7.	Overall score	25-58	59-92	93-125

Source: own research

Interpretation

In order to interpret the results, we can assess both the general level of critical thinking of a person as well as the level of competence in particular areas. It should be kept in mind that these areas are not entirely disjointed. The tool allows assessing in which of these a person feels particularly strong and which of them uses more willingly, more often.

Remembering – A person with high scores on this scale easily recalls important information and uses the appropriate knowledge; is able to repeat important

threads after reading the text. They easily remember essential information that they learned in the previous levels of education, that they once read about.

Understanding – A person with high scores on this scale can give meaning to various types of information, understands texts from various fields, likes to compile different opinions and compare them with each other. Such a person likes to discuss, has no problem with paraphrasing. They think beyond the statement – they pay attention to its contexts, nuances and overtones.

Applying – A person with high scores on this scale can evaluate and verify the information, willingly shares new knowledge and uses it in everyday life. During the conversation, refers to specific examples.

Analysing – A person with high scores on this scale tries to analyse the surrounding reality thoroughly, likes to find dependencies even between phenomena that differ from each other. They can extract the most important fragments of texts. They are looking for a connection of information from different texts.

Evaluating – A person with high scores on this scale is able to assess and verify the information. After reading the text, they check the information (that interests them, or is important to them), even if it seems true. During the discussion, they care about justifying their position and understanding the other side simultaneously. They use multiple sources to evaluate information.

Creating – A person with high scores on this scale likes and is able to create structures, connect parts together. They like to combine information from different texts. They can express the same content in many ways. Furthermore, they like to look for new meanings in texts they already know. Such a person believes that it is still possible to invent, create something completely new. They combine various opinions, and they form their own on this basis.

Critical Thinking Questionnaire (CThQ) - [KEY]

Authors of the questionnaire: Aleksander Kobylarek, Luba Ślósarz, Kamil Błaszczyszki

sex:

age:

education degree:

The following is a list of 25 statements. Please rate on a scale of 1 to 5 to what extent you agree with the given statement that applies to you (**from 1 – strongly DISagree to 5 – strongly agree**). There are no good or wrong answers. Do not spend too much time on individual statements, and mark the answer that first seemed closest to what you think about yourself. The research is completely anonymous, and the results will only be used for research purposes.

Nr	Code		1	2	3	4	5
1	E3	After reading it, I check important information, even if it seems to be true					
2	C1	I like combining information from different texts					
3	X1	I am willing to share the newly gained information					
4r	A1	In-depth analyses of reality are a waste of life					
5	R1	After reading it, I am able to repeat important threads from the text					
6	C2	The same content can be expressed in many different ways					
7	U1	I can understand texts from various fields					
8	C3	I form my impression on the basis of various information that I combine with each other					
9r	C4	Everything already exists, so nothing completely new can be created					
10	X2	When I talk, I give many examples					
11	E1	In the discussion, I care about justifying my stance on the matter and understanding the other party at the same time					
12	A2	I like finding dependencies between seemingly different phenomena					
13	C5	I can see the structure of the text, and I could change it					
14	X3	When discussing, I try to use practical examples to justify my stance on the matter					
15	R2	If necessary, I can recall information about which I once read					

16	E2	When I am interested in some information, I try to check if it is true					
17	A3	I can extract the most relevant parts of a text					
18	E4	To evaluate the information, I check many sources					
19	R3	I do not remember much from what I was learning at school					
20	C6	I like discussing new meanings in texts that I already know					
21	U2	I like to collate different opinions and compare them with each other					
22	U3	I have difficulties with paraphrasing					
23	X4	I try to use the information I have learned in everyday life					
24	A4	When I read the text, I am researching for a relationship between the information it contains and other texts that I have read					
25	U4	I pay attention to the contexts, nuances and overtones of the statements					

A - Analysing – 4, 12, 17, 24 - 19

E - Evaluating – 1, 11, 16, 18

C - Creating – 2, 6, 8, 9, 13, 20

R - Remembering – 5, 15, 19

U - Understanding – 7, 21, 22, 25

X - Applying – 3, 10, 14, 23

r - reversed scoring

In case of questions marked with a lowercase letter “r” (4, 9, 19, 22), the reversed scoring should be used (1 will mean the highest number of points and 5 the lowest).

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