

The Influence of Selected Variables on University Students' Critical Thinking Level: Preliminary Results

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Abstract

Critical thinking is necessary not only to understand the academic content, but also to effectively carry out activities related to one's own profession. The aim of the research was to identify the level of critical thinking in university students and to determine the influence of selected variables on the level of critical thinking. The variables were gender, age, use of the media, necessity of the media, up-to-date information, up-to-date professional information, and health information on the Internet. Fifty respondents studying at university participated in the research. Both bachelor's and master's students at the age of 21 to 36 were involved in the study. In order to achieve the set goal, a quantitative approach was adopted using a critical thinking test (Critical Thinking Test for university Students – CTTUS) as a research technique. Descriptive, inductive and multivariate statistics were applied for the data analysis. Age and gender emerged as important factors. Information literacy, which can significantly affect the level of critical thinking, can also be an important factor in the education of pupils and students. Finally, the study limitations are presented.

Keywords: critical thinking, university students, preliminary results, quantitative approach.

Влияние некоторых переменных на уровень критического мышления студентов: предварительные результаты исследования

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Аннотация

Критическое мышление необходимо не только для успешного освоения материала академических дисциплин, но и для эффективного осуществления любой профессиональной деятельности. Цель исследования – выявить уровень критического мышления у студентов и определить, что и как влияет на критические способности учащихся. В качестве переменных выступили пол, возраст, использование СМИ, потребность в СМИ, актуальная информация, актуальная информация из профессиональной области, интернет-информация по медицине. В исследовании приняли участие 50 студентов в возрасте от 21 до 36 лет, обучающиеся по программам бакалавриата и магистратуры. Для достижения поставленной цели была выбрана количественная методология с использованием теста по измерению критического мышления (CTTUS – Тест по измерению критического мышления студентов) в качестве исследовательского инструмента. Для анализа данных применялась описательная, индуктивная и многомерная статистика. Было выявлено, что информационная грамотность, возраст и пол являются важными факторами, так как имеют существенное влияние на уровень критического мышления. В заключении представлены ограничения исследования.

Ключевые слова: критическое мышление, студенты университета, предварительные результаты, количественный подход.

Introduction

The famous quote from American cultural anthropologist Margaret Mead reads: “Children must be taught how to think, not what to think”. These words, of course, do not only apply to children, but nowadays very aptly describe the essence of education at all its levels. In this context, perhaps one of the most discussed skills (not only) in education is critical thinking (CT) (Alsaleh, 2020; Hart et al., 2021). This concept is not new. Philosophers are discussing the quality of thinking and “right” thinking throughout history, beginning with Socrates, Plato and Aristotle and ending with current considerations from CT experts such as Ennis (1996) or Facione (1990).

It is in today’s extremely rapidly changing information and knowledge society, where innovation is the driving force of the economy, specific skills are needed for successful private and professional life by assessing the relevance of information, understanding it in the context, selecting and using the right information to make effective decisions and solve problems. In the 21st century, critical thinking is becoming an inevitable disposition for university students to be able to succeed in a changing global labour market. They can distinguish facts from half-truths and misinformation, attitudes based on rational arguments, a healthy sense from emotions, populism and demagoguery, democracy and the principles of a democratic society (Facione, 1990; Fisher, 2011).

Considering the above, the research is focused on assessing the level of CT of public university students in Slovakia using the critical thinking assumption test taken from the Czech Republic and standardized to the Slovak environment.

Literature review

Critical thinking is necessary not only to understand the academic content, but also to effectively carry out activities related to one’s own profession (Anisimova, Sabirova & Shatunova, 2020; Kassymova et al., 2020; Lin et al., 2021). The European Commission also pays attention to CT in education by supporting the ‘Critical Thinking Across the European Higher Education Curricula – CRITHINKEDU’ program. However, the outcome of the CRITHINKEDU project (Dominguez, 2018) implies that higher education professionals may not always have a clear idea of how to integrate CT into education, and education systems of individual countries do not explicitly support the development of CT. Several researchers also pointed out the often ineffective methods and procedures for developing and teaching skills and dispositions of CT in this context (Hammer & Green, 2011).

This problem may be related to the conceptualization of the term CT itself, as there is no consensus on its meaning, scope or application and its definition remains ambiguous and problematic even today, more than 100 years after John Dewey (1910) came up with the concept of reflexive thinking. Given that CT is a multidimensional concept and is viewed by experts in various fields primarily through the optics of their work, this task is very complicated. This short but relatively clear definition briefly captures the essence of CT, leaving enough room for its application across domains.

Despite the existence of many diverse concepts of critical thinking (Facione, 1990; Erkaya, 2005; Fahim & Ahmadian, 2012; Gonda et al., 2020; Gonda & Tirpakova, 2018; McPeck, 1981; Mulnix, 2012; Paul, 1989; Paul & Elder, 2007; Scriven & Paul, 2008; Sternberg, 1985), their fundamentals remain overwhelmingly consistent, and the Delphi Report definition sufficiently covers the basis of CT.

Along with the definition of the term, it is essential to consider the skills that critical thinking covers. In the Delphi Report, the basic skills include analysis, inference, explanation, evaluation, self-regulation, interpretation, and the authors separate these skills from dispositions, including features such as trust in reason, curiosity, openness (Facione, 1990).

It is the CT skills that can be evaluated and based on these skills the students' academic level of CT can be determined. Universities in the USA evaluate these skills through many standardized tests such as WGCTA, HCTA Cornell Test. Though the CT assessment has an international scope, the availability of standardized tools outside the U.S. is very limited. This problem affects educators at European schools, with most assessments focusing on qualitative methods and little focus on formal CT testing, where its level and progress could be measured (Dominguez, 2018). Due to different types of standardized assessment, it is possible to assess not only the students' general level of CT skills, but also the quality of the educational process and the effectiveness of teaching or methods focused on CT.

A large body of literature confirms the importance of this issue. In the Netherlands, the university students' CT level was examined by Verburgh et al. (2013), using the Dutch version of HCTA on a sample of $n = 240$. The study investigated the psychometric quality of a survey. For nearly 40 % of students the test was too difficult, and half of the respondents mentioned that the test was too long. In Portugal, determination of the psychometric characteristics of HCTA was studied by Franco et al. (2018), who examined the CT level of the student sample $n = 333$. They also explored differences in the CT level between two disciplines - science and technology and social sciences and humanities and between two academic levels - graduate degree and master's degree. In both cases, statistically significant differences were found when students of science and technology achieved a higher score compared to students of social sciences and humanities. As for the academic level, master's students outperformed graduate students. Mehta et al. (2018) examined the level of CT on a sample of first-year students at the University of Oman ($n = 60$). The overall correct percentage for the whole test was 45.8% and, among other things, independent t-tests were conducted to determine if there were statistically significant differences in the test scores between sex and age (18 years old or younger and 19 years old or older). Gender showed statistically significant differences in the critical thinking test scores with women's results higher than men. There were no statistically significant differences in age. Lin et al.'s study (2020) focused on how participants in both academia and industry settings vary in their perceived self-efficacy in critical thinking after using online training units with information and communication technologies. The author concluded that perceived self-efficacy increased critical thinking skills.

Therefore, the clear definition of critical thinking is highly needed, as there are many various definitions and interpretations. The reviewed studies operated with different research tools, mainly focused on the cognitive aspect of critical thinking. Prior research also considered variables, which could influence the critical thinking level. Our research tool was focused on the cognitive, affective, and conative aspect of critical thinking.

Research Methodology

General Background

This paper presents preliminary results of a pilot study conducted in the spring semester 2019 among university students. The authors have opted for a quantitative research design. Based on the findings, the hypotheses will be determined and then they will be verified in the main research.

Research Focus

The present study was aimed to assess the level of critical thinking among university students and to determine the influence of selected variables. The variables were gender, age, use of the media, necessity of the media, up-to-date information, up-to-date professional information, and health information on the Internet.

On the basis of the research aims, the following research questions were formulated:

1. What is the level of critical thinking among Slovakian university students?
2. Which of the chosen variables can affect the level of critical thinking among university students?

Sample

Fifty respondents studying at the Slovakian university participated in the research. Both bachelor's and master's students aged 21 to 36 were represented ($x = 23.00$; $SD = 2.84$). Respondents were selected by convenience sampling and the sample size was sufficient to carry out research examinations (Kivunja, 2015; Newby, 2014). The number of men in the research was 24 and the number of women was 26. Most of the participants were students obtaining the bachelor's degree ($n = 43$), the rest were students of the master's degree. Another demographic variable was related to media usage. For most respondents ($n = 20$), social interaction is a primary activity. Twelve respondents use it mainly for entertainment and education. Others have indicated that they primarily use it to search for information. All the respondents indicated that the media were essential for education (the term "media" in the context of this research means the use of web services for different purposes). In terms of searching for health information, 26 respondents chose the Internet as their primary choice.

Instrument and Procedures

In order to achieve the research aims, a quantitative approach to data collection and analysis was carried out through a critical thinking test as a research technique. Prior to the actual administration of the research tool among students, a pre-research was carried out, in which the methodologists involved in the design of research tools were asked to evaluate the critical thinking test. After the pre-research phase, some stylistic changes to the test items were made. The psychometric properties of the research tool were verified and have been described in the study by Sustekova et al. (2019).

The Critical Thinking Test (called Critical Thinking Test for University Students - CTTUS) consists of 40 questions, each of which has four options and only one answer is correct. The questions are divided into 3 parts, i.e. analytical, evaluative and inferential. Additionally, the test includes demographic items. The test had not got subtest.

The test was distributed to students through an electronic link provided to them by e-mail or as a social network link. The students familiarized with the purposes of using the obtained data and their anonymity was assured. The completion time did not exceed 30 minutes and all tests were completed in such a way that they could be included in the research investigation.

Data Analysis

After obtaining the results, the data were transferred to MS Excel. The responses were coded by assigning 0 to an incorrect answer and 1 to a correct answer. Subsequently, the reliability of the data was determined by means of the Cronbach alpha (α) coefficient. For the whole test, the coefficient value was 0.83, indicating the high reliability of the research tool. For each section, the values were as follows: analytical section ($\alpha = 0.62$); evaluation part ($\alpha = 0.71$); inference part ($\alpha = 0.63$). Inductive statistics tests, specific analysis of variance and Pearson correlation coefficient were used to determine the differences between groups of variables. The data were processed in SPSS 22.0, STATISTICA 10.0 and Microsoft Excel 10.0.

Research Results

The overall level of critical thinking in the university students was $x = 0.45$ ($SE = 0.02$; $Min = 0.17$; $Max = 0.90$). Within the evaluation of individual dimensions, the highest score in the inference dimension ($x = 0.49$; $SE = 0.03$) was achieved and the lowest score in the evaluation dimension ($x = 0.43$; $SE = 0.03$). The test distribution within critical thinking dimensions is shown in Figure 1.

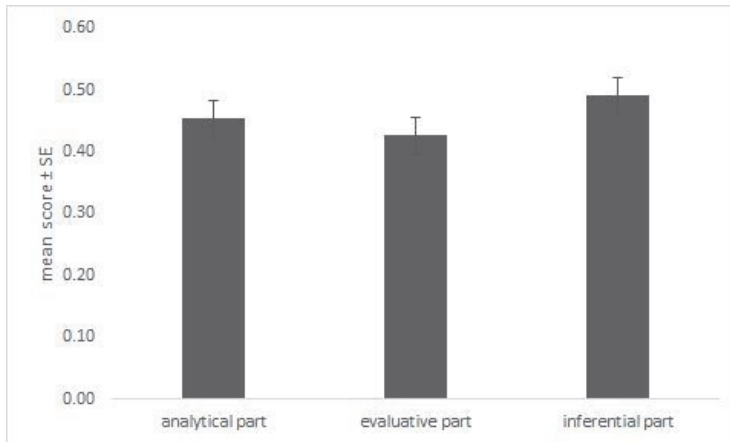


Figure 1. Distribution of scores within critical thinking dimensions

Considering the influence of each variable, a significant difference was identified between men and women ($F = 6.80$; $p < 0.05$), with women achieving a higher level of critical thinking ($x = 0.51$; $SE = 0.03$) compared to men ($x = 0.39$; $SE = 0.03$). There was also a difference in the evaluation of individual dimensions. Figure 2 shows that women scored at a higher level than men in all dimensions of critical thinking. A significant difference was identified in two dimensions (evaluative and inferential).

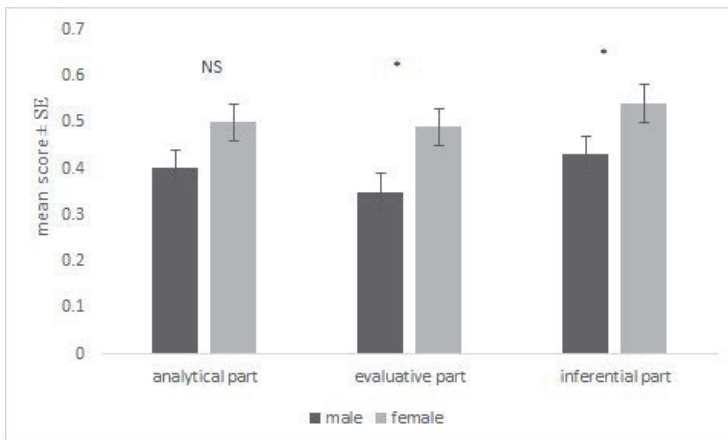


Figure 2. Distribution of scores in individual dimensions of critical thinking with respect to gender

NS – non-significant difference

* $p < 0.05$

Age proved to be a significant variable when a significant positive relationship between age and the level of critical thinking was identified ($r = 0.36$; $p < 0.01$). When evaluating the relationship between age and the dimensions of critical thinking, there was no significant difference in the analytical dimension ($r = 0.13$; $p = 0.36$). For the other two, evaluation and inference, a significant positive relationship was identified ($r = 0.42$; $p < 0.01$ and $r = 0.34$; $p < 0.05$).

The other variables did not affect the level of critical thinking among the respondents. The values of variance analysis along with the average score for each variable group are given in Table 1.

Table 1. Mean scores and F values for the observed variables

Variables	Groups of variables	X	SE	F	p
Media use	Education, work,	0.48	0.05	1.97	0.12
	Entertainment	0.34	0.05		
	Social interaction	0.50	0.04		
	Search for information	0.42	0.10		
Necessity of media	Yes	0.47	0.03	2.43	0.13
	No	0.34	0.08		
Sources of actual information	Internet search engine	0.39	0.04	2.38	0.07
	Social media	0.38	0.07		
	Internet news portals	0.52	0.05		
	Mass media	0.46	0.04		
Sources of specific information	Internet search engine	0.44	0.04	1.32	0.28
	Scientific databases	0.45	0.06		
	Wikipedia	0.30	0.12		
	libraries	0.45	0.04		
Searching for health information on the Internet	Yes	0.41	0.03	3.55	0.07
	No	0.50	0.03		

The variable “searching for health information on the Internet” had not got significant effect. For both groups, those who do not seek health information on the Internet, and those who reached an average level of critical thinking, it could be stated that critical thinking did not have a significant impact on whether the respondents trusted health information presented on the Web (Figure 3).

Discussion

The aim of the research was to determine the level of critical thinking among university students of high schools and to determine the influence of selected variables. The level of critical thinking was average, with an overall score below 0.50, which means that the number of correct answers was less than 50%. This level of critical thinking was similar in comparison with other researches. Foreign studies in almost all cases addressed the impact of variables on the level of critical thinking (Erkaya, 2005; Fahim & Ahmadian, 2012; King et al., 1990). There are some studies which, in addition to the effect of selected variables, have mentioned the overall level of critical thinking among university students (Akgun & Duruk, 2016; Bakir, 2015; Facione et al., 2000). Ranging from average to low level of critical thinking among Slovak university students may be due to a learning style focused on memorizing information without developing critical thinking skills (Nedelova & Sukolova, 2017; Pisutova-Gerber & Malovicova, 2009). Lower levels

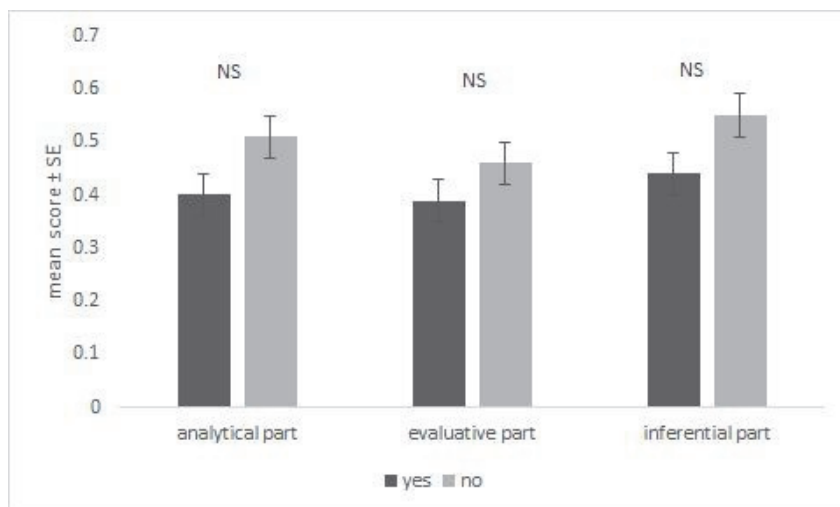


Figure 3. Distribution of scores in each dimension of critical thinking with respect to the variable - searching for health information on the Internet

NS – non-significant difference

of critical thinking skills could be caused by the low level of information literacy. The importance of information literacy for the development of personality was mentioned in some studies (Cvetkovic et al., 2018; Erdogan et al., 2019).

The gender variable proved to be a significant factor when women achieved significantly better scores in the critical thinking test compared to men. Contradictions on this matter can be found when compared to the results of other studies, as most findings pointed to the opposite trend, when boys achieved a higher level of critical thinking (Preiss et al., 2013) or when there is no significant difference between men and women (Salahshoor & Rafiee, 2016). Our results are consistent with earlier research (Akgun & Dukur, 2016). Although many theories posit that boys have a higher level of critical thinking, Walsh and Hardy (1999) have pointed out the influence of subjects on the basis of which critical thinking tests are designed. If the test was based on mathematics, men scored higher, but the opposite trend was shown in tests based on social science subjects (Arisoy & Aybek, 2021). Similar considerations, even marginally, are also presented in the work of Facione et al. (1995). This may explain why, in our case, women reached a higher level of critical thinking.

Another variable that had a significant impact on the level of critical thinking was the age of the respondents. The correlation showed a positive and significant relationship between age and the level of critical thinking, which means the higher the age of respondents, the higher and more developed the level of critical thinking among university students. This result is supported by other researchers (Becirovic, Hodzic & Celjo, 2019; Ghazivakili et al., 2014; Pascarella et al., 1996). The number of studies that have not confirmed the relationship between age and the level of critical thinking is scarce (Ghanizedah & Moafian, 2011; Kettler et al., 2018). The reason why higher levels of critical thinking occur with increasing age may be because students gain different knowledge during their studies, they need to work not only with ready-to-use information in the

form of textbooks or dictated notes, but they must seek information from available sources and select which ones are trustworthy and which are not.

Other variables did not have a significant effect on the level of critical thinking. All the insignificant variables were connected with the use of web services and Internet for different reasons. The use of media for the educational and non-educational purposes did not have effect on the level of critical thinking, thus it could be caused by the character of information presented on Web servers. This finding is in contradiction with other results. Kim et al. (2018) found the positive effect of the Internet use on the level of critical thinking in biology classes. The similar results are found in the study of Samsudin and Hardini (2019). However, our findings could be distorted by the general use of media on the level of critical thinking. Earlier studies have a clear focus on the use of media in concrete disciplines, lessons and topics. This can be a reason, why we did not find out significant effect.

Conclusions

It should be stressed that the research findings are only preliminary and they cannot be generalized to the entire study population. Therefore, it is planned to increase the sample size as part of further research. The results indicated the impact of such variables, as gender, age, use of Internet resources, media use, necessity of media, sources of actual information, sources of specific information and searching for health information on the Internet. Information literacy, which significantly affect the level of critical thinking, can be one of the variables in the next research. Often the quantitative approach may lack depth. Thus, qualitative research methods, for instance, interviews or focus groups, can be valuable for results analysis and their presentation.

The implications for pedagogical practice are limited due to the character of study, which is a pilot one. However, according to the preliminary results, the university students had a low level of critical thinking, so the change of teaching, not only in universities, but also in elementary and high schools is necessary. The situation with teaching is changing slowly. The transition from teaching focused on memorization to thinking processes would be helpful in this situation. Though, it is impossible to implement these changes without adequate preparation of pre-service teachers.

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Conflict of interest

There is no conflict of interest.

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