SOCIAL MEDIA USE AND CRITICAL THINKING OF ADOLESCENTS

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Abstract: Social media is an important source of information for adolescents. The aim of our research was to analyze the relationships between general critical thinking and components of media literacy. Our 64 participants were 1st year students of Psychology of Constantine the Philosopher University in Nitra. They completed self-report and objective measures, e.g. Perception about social media personalized news algorithms (Ku et al., 2019); Digital Literacy scale (Rodríguez de Dios et al., 2016); Watson-Glaser Critical Thinking Appraisal (Watson & Glaser, 2000); 2 forms of Cognitive Reflection test (Frederick, 2005, Sirota et al., 2021). The results differ from our formulated hypothesis. We assume, for adolescents it is a rather demanding task to evaluate their level of media literacy, transfer their general critical thinking to a specific domain of social media.

Keywords: critical thinking; analytical thinking; adolescence; media literacy

INTRODUCTION

Digital technologies and social media have become crucial parts of people´s lives all around the world (Rodríguez de Dios et al., 2016). Thanks to them many users can easily access information about any topic they are interested in. 84% of adolescents are regular users of social media as well (Ec Europa, 2023), within their environment they are exposed to an information overload. Skills such as critical thinking and media literacy can be useful when trying not to get overwhelmed by such amount of data (Potter, 2010). Despite the fact that adolescents´, 15-22 years old youngsters´, cognitive skills are reaching their peak (Langmeier & Krejčířová, 2006) and the fact that they belong to the category of digital natives, most of them do not possess highly developed skills of critical thinking and media literacy (Lessenski, 2022).

Therefore, we have decided to investigate the relationships between adolescents´ general critical thinking and their use of social media, i.e. components of media literacy. In our research, we looked at critical thinking from several perspectives. We described critical thinking as a skill, combination of several subskillls when a person uses more complicated operations and also in terms of using a quality of thinking, slow, analytical thinking and its two types, numerical and verbal analytical thinking. Among the components of media literacy, we included attitude towards personalized algorithms and digital literacy.

Critical thinking

The term critical thinking (CT) can be derived from Greek words kriterion (norm, rule) and kriticos (able to discriminate). It can be defined as making inferences/judgements based on certain rules (Paul & Elder, 2003).

Watson and Glaser (2000) define CT as a combination of skills, knowledge and attitudes. They focused on several subskills that are involved in CT:

1. making inferences, i.e. the ability to distinguish between false and true conclusions that were made from the given information;
2. recognition of assumptions, reflecting the skill to differentiate between facts and opinions;
3. deduction, the ability to decide whether a conclusion was logically derived from the given information;
4. interpretation, the ability to evaluate proofs, facts, relevance of conclusions;
5. evaluation of arguments, their strength, relevance, validity in relation to a given problem (Watson & Glaser, 2000).

CT can be viewed in terms of the existence of two systems of human mind, system 1 and system 2 as well. System 1 is usually characterized as more intuitive, fast, automatic, emotional, focusing on the whole and operating without intentional control. System 2 engages more profound reasoning, focuses attention, operates in a slowly way, follows several rules, evidence, processes abstract concepts, makes plans, considers several options when solving a problem. It creates bases for CT, is often called as a controller, slow, analytical, or reflective thinking (Kahneman, 2011). According to Frederick (2005) it can suppress the automatic, intuitive responses of the mind, system 1.

We can distinguish between numerical and verbal analytical thinking. Numerical analytical thinking requires the use of mathematical operations while solving a certain problem (Sinayev & Peters, 2015). Verbal analytical thinking is connected to solving verbal problems that do not require the use of mathematical operations, nor the manipulation with numbers (Sirota et al., 2021).

It is possible to learn how to analyze, reflect our own judgements and suppress the intuitive responses (Kahneman, 2011). One can benefit from such quality of thinking, for example, while using social media, when trying to become a media-literate individual.

Media literacy

Media literacy is a skill thanks to which a person gains access to different types of media. A media-literate person is able to search, analyse, understand the way of their functioning, think critically about several aspects of media, create his/her own content, opinions and attitudes, understand the environment that contributes to the creation of the view of the world (Nutil, 2018). Attitude towards personalized algorithms and digital literacy are key components of media literacy (Tímár, 2019).

Algorithms are mechanisms, sequences of procedures through which certain data are processed and then form new information. They function as filters (Bozdag, 2013) that select which information will be displayed to the users of social media. This way they create content that perfectly matches the users´ interests. Their existence brings several advantages and disadvantages. Information can be selected from reliable sources, this way the users can widen their knowledge in a certain area or avoid content that is not interesting to them. On the other hand, users may not be informed about events, news, opinions that do not fall within the created algorithm (Bozdag, 2013).

Digital literacy is a broader concept than media literacy, is described as the ability to read, understand hypertextual or multimedia content (Rodríguez de Dios et al., 2016). There was created a 5-dimensional model that focuses on components of digital literacy (Rodríguez de Dios & Iguarta, 2016):

1. technical skills, i.e. the ability to use digital tools effectively;
2. communication skills, i.e. the ability to communicate through digital means;
3. information skills, i.e. the ability to search for, find, gain access, evaluate a certain information;
4. critical skills, i.e. the ability to critically analyze the gained information;
5. safe use skills, i.e. the ability to use digital communication, technology without putting oneself at risk.

Critical thinking and media literacy

The main aim of our research was to investigate whether adolescents 'general CT is related to their way of use of social media. Therefore, we have decided to investigate the relationships between adolescents´ CT (skill- subskills- making inferences, recognition of assumptions, deduction, interpretation, evaluation of arguments; numerical analytical thinking; verbal analytical thinking) and the way of use of social media, i.e. components of media literacy (attitude towards personalized algorithms; digital literacy).

Previous research has demonstrated that participants with negative attitude towards personalized algorithms had a significantly higher level of CT than participants with positive attitude towards personalized algorithms (Ku et al., 2019). Therefore, we expected:

Positive relationship between adolescents´ CT (H1: skill- subskills- H1a: making inferences, H1b: recognition of assumptions, H1c: deduction, H1d: interpretation, H1e: evaluation of arguments;

H2: numerical analytical thinking; H3: verbal analytical thinking) and negative attitude towards personalized algorithms on social media.

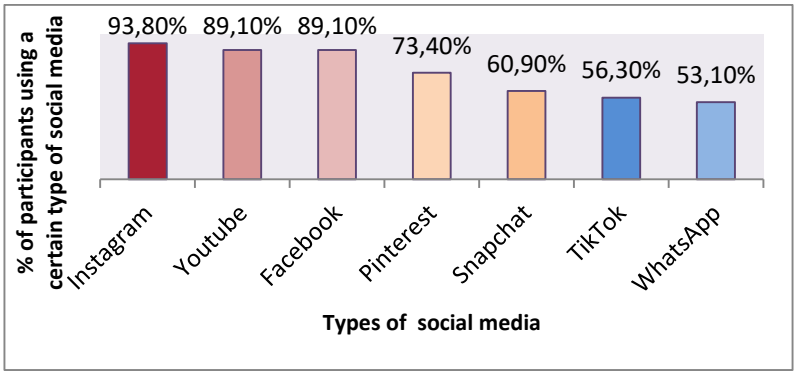
Research investigating the connections between CT and digital literacy pointed out statistically significant relationships (Haryanto et al., 2022; Ku et al., 2019). Therefore, we expected:

Positive relationship between adolescents´ CT (H4: skill- subskills- H4a: making inferences, H4b: recognition of assumptions, H4c: deduction, H4d: interpretation, H4e: evaluation of arguments; H5: numerical analytical thinking; H6: verbal analytical thinking) and digital literacy.

METHODS

Participants

The research sample consisted of 64 Psychology students of Constantine the Philosopher University in Nitra, Faculty of Social Sciences, and Health Care, attending first grade. Four participants from the original sample of 68 students were excluded due to incomplete research battery. The selection of participants was non-representative. Respondents were aged 19-22 (M = 19,92; SD = 0,72), 56 women (87,5%), 8 men. More than half of the participants (n = 35; 54.7%) spend between 1 and 3 hours per day on social media. The most frequently used social networks by participants are shown in Chart 1. All 64 participants were aware that social networks use personalized algorithms to select information for their users.



Graph 1: Participants´ most frequently used social media

Research design

Our research design was correlational, quantitative, non-experimental, and cross-sectional. Data collection was conducted in person, in early June 2023, during a Cognitive psychology course. Participants completed the chosen pencil-and-paper measurement instruments at a time interval of approximately 1 hour and 20 minutes. To anonymise them, they were assigned an identification number. All participants agreed to the use of their results for the purpose of our work.

Measures

To measure CT and the components of media literacy, we chose several measurement tools. We also collected basic information regarding gender, age, type of school attended, social networking sites used, and the average time spent daily using social networking sites by our participants.

To measure CT as a skill, we used the Watson-Glaser CT Assessment, Form C (T-185) (hereafter W-GCTA). Form C was developed in 1991 and is available in Slovakia but has not been standardized for the Slovak population (Watson & Glaser, 2000). It is a test of specific abilities that measures a unidimensional aspect of CT. It consists of 80 items that are divided into 5 subtests, each subtest consisting of 16 items. The subtests are related to reasoning, recognition of assumptions, deduction, interpretation, and argument evaluation (see Fig. 1). Some items are multiple choice, others are dichotomous. It is also possible to obtain a subscore for each subtest. Higher raw scores are indicative of higher CT ability. Acceptable split-half reliability (α= 0.88) has been demonstrated (Watson & Glaser, 2000).

Picture 1: Example of an item from W-GCTA, subskill recognition of assumptions

We used the Cognitive Reflection Test to measure slow, analytical thinking. Two different forms were used, i.e., the Verbal Cognitive Reflection Test (hereafter CRT-V) (Sirota et al., 2021) and the Numerical Cognitive Reflection Test (hereafter CRT-N) (Frederick, 2005). Neither of these has been standardized on a Slovak population. The CRT-N consists of 3 items, for each of which a correct and intuitive answer was offered. Higher raw scores are indicative of a higher level of numerical analytical thinking. Due to the lower number of items, it is a measurement tool with lower reliability, internal consistency ($\alpha = 0.33$). For example: *Coffee and milk together cost €1.20. Coffee costs €1.00 more than milk. How much does milk cost? 10 cents; 20 cents*

The CRT-V measurement tool was created to measure analytical thinking skills without the use of mathematical tasks that may induce anxiety, restlessness (Sirota et al., 2021). It consists of 10 items where an intuitive response and a correct, rational answer are given. In our research, we did not administer response options to participants. The maximum attainable raw score is 10 points; the internal consistency coefficient was acceptable in our study ($\alpha = 0.8$). A higher attainable raw score is indicative of a higher level of verbal analytical thinking. For example: *Laura's father has 5 daughters, no sons. Four of them are named Nana, Nene, Nini, Nono. What is the likely name of the fifth daughter?*

To measure attitudes toward personalized algorithms, we used a self-report questionnaire by Ku et al. (2019), which was pilot tested by the authors. The questionnaire consisted of 2 parts. Part 1 focused on awareness of the existence of personalized algorithms, part 2 on attitudes towards them in social networking environments. 3 items were related to negative, 3 to positive attitudes towards personalized algorithms. Each statement was scored on a 5-point Likert scale (1-completely disagree, 5- completely agree) (see Fig. 2). Items related to positive attitude were recoded. A higher achieved gross score is indicative of a more negative attitude, while a lower achieved gross score is indicative of a more positive attitude towards personalized algorithms. In our study, the internal consistency coefficient was satisfactory ($\alpha=0.61$). For example: *It appears to me as privacy violation*.

The digital literacy measurement tool was part of a self-report questionnaire by Rodríguez de Dios et al. (2016), focusing on the ability to critically evaluate the information received. It is based on the model of the 5 dimensions of digital literacy that we described in the introductory section. It consisted of 5 statements scored on a 5-point Likert scale (1-completely disagree, 5-completely agree) (see Fig. 3). A higher achieved raw score is indicative of a higher level of digital literacy. Acceptable reliability of the selected part of the questionnaire has been demonstrated ($\alpha=0.75$)

(Rodríguez de Dios et al., 2016), the internal consistency coefficient was acceptable in our study(α=0.68). For example: *I know how to compare different sources to decide if information is true*.

Data analysis

The data obtained were evaluated using IBM SPSS Statistics 20 (IBM Corp. Released 2011). We focused on the descriptive characteristics of the variables under study. Subsequently, we used parametric Pearson's and nonparametric Spearman's correlation coefficients to detect relationships between variables when the normality condition was not met.

RESULTS

First, descriptive statistics of the studied variables were calculated. Results are displayed in Table 1.

Table 1: Descriptive characteristics of CT and components of media literacy

Critical thinking	N	M	Mdn	SD	Min- Max	Skew	Kurt
Making inferences	64	7,67	7,00	2,23	3-13	,322	-,640
Recognition of assumptions	64	10,98	11,00	1,79	6-15	-,304	,375
Deduction	64	8,66	9,00	2,01	2-14	-,406	,299
Interpretation	64	9,98	10,00	1,92	6-16	,286	,575
Evaluation of arguments	64	11,38	11,00	1,96	5-15	-,547	,674
Numerical analytical thinking	64	2,45	3,00	0,754	0-3	-1, 438	1,942
Verbal analytical thinking	64	6,70	7,00	2,63	1-10	-,651	-,656
Media literacy							
Negative attitude towards personalized algorithms	64	18,63	18,00	3,43	12-29	,615	,714
Digital literacy	64	19,61	19,00	2,83	11-25	,031	,558

n = sample size, M = mean, Mdn = median, SD = standard deviation, Min – Max = minimum-maximum, Skew = skewness, Kurt = kurtosis

Then we calculated correlations between CT variables and negative attitudes towards personalized algorithms on social networking sites among adolescents (Table 2). We also analysed the correlations between CT and digital literacy in adolescents (Table 2).

Table 2: Relationships between CT and components of media literacy

Media literacy	Negative attitude towards personalized algorithms	Digital literacy
Critical thinking		
Making inferences	,058	-,063
Recognition of assumptions	,054	,036
Deduction	,170	-,035
Interpretation	,098	,048
Evaluation of arguments	-,028	-,247*
Numerical analytical thinking	,001	,136
Verbal analytical thinking	-,039	,758

* $p < .05$

After performing statistical analysis for H1, H1a, H1b, H1c, H1d, H1e, H2 and H3, we can conclude that the results do not indicate a statistically significant relationship between CT (ability, sub-skills; numerical and verbal analytical thinking) and negative attitudes towards personalized algorithms on social networking sites among adolescents. Because of this, we reject the hypotheses.

After conducting statistical analysis for H4, H4a, H4b, H4c, H4d, H4e, H5 and H6, we can conclude that the results almost in no case indicate a statistically significant relationship between CT (ability sub-skills; numerical and verbal analytical thinking) and digital literacy in adolescents. In the case of the link between the sub-skill of argument evaluation and digital literacy, we identified a statistically significant negative relationship, which we had not originally predicted. Because of this, we reject the hypotheses.

DISCUSSION

The main aim of our research was to investigate whether adolescents´ general CT is related to their way of use of social media. Therefore, we have decided to investigate the relationships between adolescents´ CT (making inferences, recognition of assumptions, deduction, interpretation, evaluation of arguments; numerical analytical thinking; verbal analytical thinking) and the way of use of social media, i.e. components of media literacy (attitude towards personalized algorithms; digital literacy). The results differ from our formulated hypothesis.

Critical thinking and media literacy

We hypothesized that there would be a positive association between CT (ability, numerical, and verbal analytical thinking) and negative attitudes towards personalized algorithms on social networking sites among adolescents (H1a-e; H2; H3). Our findings did not support these

hypotheses. The findings did not indicate that adolescents who possess higher levels of CT tend to hold more negative attitudes towards personalized algorithms on social networks.

We also hypothesized a positive association between CT (ability, numerical, and verbal analytical thinking) and digital literacy in adolescents (H4a-e; H5; H6). It has not been demonstrated that adolescents with higher levels of CT achieve a higher level of digital literacy. We aimed to determine if adolescents who have attained a certain level of general CT can transfer it to another, much more specific area of social networking. However, previous findings on the transferability of CT to other specific domains do not provide a clear answer (Dumitru, 2013; Tiruneh et al., 2018). We believe that the unclear outcome regarding the transfer of CT to specific content is associated with our results. Each individual should reach the stage of formal operations in their cognitive development (Langmeier & Krejčířová, 2006), acquire some knowledge (Ennis, 1989) about CT, how social networks function, and then correctly identify situations requiring CT involvement. Meeting these conditions is not easy. Most of the time, individuals are guided to acquire general CT in a formal educational setting, and rarely is the possibility of connecting acquired knowledge with everyday life (Ennis, 1989; Tiruneh et al., 2018), such as social networking environments, highlighted. In this way, it is more challenging to transfer CT to the more distant realm of the negative aspects of social networks, such as the potential consequences for users brought about by personalized algorithms. It is more challenging to ensure that adolescents' general CT contributes to digital literacy. While our participants were introduced to ways of thinking and the mistakes people make in thinking during the cognitive psychology course, they also learned about the basic characteristics of CT. However, the specific area of media literacy was not addressed during the mentioned courses.

In our study, different perspectives on CT were investigated using objective measurement tools. The expression of the extent of negative attitudes towards personalized algorithms on social networks and digital literacy were examined using self-report questionnaires. Research indicates that adolescents tend to overestimate their abilities, knowledge, and to present their opinions and attitudes in a desirable manner (Gabbard & Romanelli, 2021; León et al., 2023). There is often a lack of consistency between adolescents' subjective and objective assessments of the knowledge and skills acquired during different subjects and years of study (Gabbard & Romanelli, 2021; Vraga et al., 2016). Although adolescents belonging to the group of digital natives are in contact with digital technologies from an early age, they may not objectively assess their knowledge of the digital space and social networks. As Vraga et al. (2016) point out, individuals may have difficulty objectively assessing their own abilities and knowledge regarding media. Daily use of social media does not reflect the depth of knowledge regarding the use of different technologies and social networks. We hypothesized that scores on objective tests mapping CT domains did not correlate with expressions of self-reported levels of negative attitudes toward personalized algorithms on social media, thus failing to demonstrate an association between the variables examined.

We also believe that our participants may have overestimated their own abilities and knowledge regarding social networking, which subsequently were not consistent with objective measurement tools examining CT domains, thus failing to demonstrate associations between CT and digital literacy.

In the case of the association between argument evaluation subskills and digital literacy, we identified a weak negative statistically significant relationship. The aforementioned result could be due to our participants' overestimation of their level of digital literacy, which did not correspond with their level of argument evaluation, i.e., CT subskill.

Limitation and suggestions for further research

We consider one limitation to be the chosen CT measurement instrument, the W-GCTA Form C (Watson & Glaser, 2000), which our participants reported was lengthy and laborious to complete. We recommend that future researchers choose a less time-consuming measurement instrument focusing on CT as a higher-order skill domain, or create a shortened version of the W-GCTA Form C. The CRT-N showed lower reliability; because of this, we recommend using other item types or a longer form of the measurement instrument to explore the area of numerical analytic thinking.

The characteristics of our cohort may also be a limitation, as these are first-year, single-discipline psychology students, and the results cannot be clearly generalized to a broader, less specific population of adolescents. We encourage future researchers to involve other fields of study or focus on changes in the aforementioned domains that may occur across adolescence and development.

The fact that we did not use a combination of self-report and objective measurement instruments when measuring all variables may also be a limitation. In this way, it would have been possible to determine whether adolescents always tend to overestimate their knowledge and abilities on self-report measurement instruments. If we suspect that there is no agreement in participants' subjective and objective ratings, we recommend that future researchers apply both types of measurement instruments to all domains under study.

CONCLUSION

CT and media literacy are key skills when trying to navigate the complex world of social networking, even for adolescents, who are the largest user group. Because of this, we focused on exploring the association between general CT and media literacy in adolescents. Our results yielded remarkable findings. They prompted us to reflect on the possibility that general CT may be difficult to transfer to the specific space of social networking, or that adolescents may be limited in their assessment of how they use social networking sites. Our chosen area requires further detailed investigation. Until we reach firm conclusions, we can participate in the development of CT and media literacy in adolescents and observe how the aforementioned abilities change across development. Perhaps this is the way that will help us in elucidating the links between general CT and media literacy.

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Acknowledgments

The article was written within the scope of the grant agency VEGA Critical thinking in relation to academic success and decision-making in specific areas of students' lives (project no. 1/0336/24).