

Millennials, Information Assessment, and Social Media: An Exploratory Study on the Assessment of Critical Thinking Habits



Michael Menichelli and Alessio Maria Braccini

Abstract Critical thinking is as a systematic habit of being able to question information, confront different information sources seeking diversity of points of view, understanding statements, and being able to make inferences out of information. Critical thinking is an active behavior against information processing which influences in a positive way individual and organizational decision making. While we can observe different levels of critical thinking in different individuals, millennials are reputed to possess low critical thinking skills given their habit of passively receiving information through social media. In this paper, we study the critical thinking skills of millennials, and we explore the level of critical thinking shown in relation to the reported intensity of use of social media and other traditional media for information acquisition. The paper is based on a quantitative analysis of an incidental sample of 424 millennials.

Keywords Critical thinking · Digital natives · Millennials · Information assessment

1 Introduction

Digital technologies are used for information dissemination and retrieval. Digital technologies exacerbated both individual and organizational communication capabilities and offered new venues for information dissemination for individuals and organizations [1–3]. Among these technologies, social media emerged recently for their capabilities of circulating information directly among people and both inside

M. Menichelli
Università LUISS Guido Carli, Rome, Italy
e-mail: Michael.menichelli@studenti.luiss.it

A. M. Braccini (✉)
Università degli Studi della Tuscia, Viterbo, Italy
e-mail: abraccini@unitus.it

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A. Lazazzara et al. (eds.), *Exploring Digital Ecosystems*,
Lecture Notes in Information Systems and Organisation 33,
https://doi.org/10.1007/978-3-030-23665-6_7

and outside organizations [1, 3, 4]. The dissemination potential of social media brought many opportunities for organizations and individuals [3, 5, 6]. However, they presented also challenges especially about the mass of unreliable or counterfeit material purposefully disseminated over social media to orient individuals' opinions and decision making.

In this context, we study the critical thinking skills of millennials, the generation of people born after the year 1982 [7], about their intensity of use of social media. Critical thinking is the skill to be able to critically assess information and judge its reliability [8–10]. It is a necessary skill to master the information overload and improve decision making [11]. To reach our objectives, we run an exploratory study to investigate the level of critical thinking of future members of the workforce in organizations. We distributed a survey containing both self-assessed measures of critical thinking and information analysis tasks through which we could directly assess the critical thinking level. We focused specifically on millennials as the literature suggests they are a generation of digital natives, born and immersed in a digitized world, using digital technology for communication and information dissemination [12, 13].

2 Theoretical Framework

The capability to acquire and process information is at the basis of the three fundamental organizational processes: sense making, decision making, and knowing [14]. We define critical thinking as the capability to critically evaluate pieces of information found on online sources, and to choose the most authoritative ones [8, 9, 15]. While thinking is a capability of human being, critical thinking is a specific kind of reflexive thinking, open to changing and improving the points of view of the thinker, and it is an active process on concepts and information [16].

Under a managerial perspective, critical thinking is an approach to problem setting and analysis with the potential to improve the effectiveness of decision-making processes [11]. It is an organized and systematic way of thinking that involves both the problem definition phase and the assessment of the resources available and the possible alternatives [17]. Critical thinking requires active engagement with problems and solutions avoiding—to the largest extent possible—the influence of individuals' judgments.

Critical thinking is a set of capabilities about the use of information which an individual shall possess [18]:

- Interpretation: the capability to understand and express the meaning of events, situations, data, rules, processes, judgments;
- Analysis: the capability to identify relations among declarations, statements, concepts, descriptions or other forms of representation of information used to express judgments, experiences, and opinions;
- Evaluation: the capability to evaluate credibility and reliability of statements or other sources of representations of facts which stem out of individuals' perceptions,

- experience, judgments, beliefs, opinions or by the contextual conditions in which the person is to be found. The evaluation capability also extends to the possibility to assess the logic soundness among different statements, descriptions, declarations or another form of representation of information;
- Inference: the capability to identify the required elements to formulate hypotheses or consequences stemming from data, declarations, principles, tests, judgments, beliefs, opinions, concepts, descriptions or other forms of representation of information;
 - Explanation: the capability to be able to explain the path followed to assert specific considerations out of specific conditions;
 - Self-regulation: the capability to apply critical thinking to themselves to improve one's opinions.

2.1 Critical Thinking and Millennials

Individuals differ regarding critical thinking capabilities. Systematic habits of questioning information, looking for alternative points of view, and assessing strong and weak points in the information to be assessed can improve critical thinking [18]. All individuals depend on heuristics and routines for information processing. Cognitive biases could influence the latter, and these biases and heuristics might influence in turn the level of critical thinking [19, 20].

Millennials are suspected of possessing low critical thinking skills, due to the passive habit of receiving information in the form of words and images on digital technologies [13]. However, they are also described as a cohort competent in information browsing and searching [8], with habits and preferences in the use of digital technologies different than that of other generations [21, 22], but with significant internal differences [9].

However, millennials are born and grown up in a world permeated by digital technologies [23]. They have expectations for easy and quick access to information, and they frequently use social media to acquire and disseminate information [24]. They are constantly connected to the network, with their smartphones and have had no previous experiences of a world different than that [25]. If and how these habits of use of social media influence their critical thinking has still to be empirically studied.

3 Research Design

To explore the critical skills capabilities of millennials about their use of social media we created and distributed a survey based on existing measurement instruments to assess critical thinking. The survey is structured in four sections as follows:

- Section one: sex, age, academic degree, the intensity of use of social media, traditional media, and press for information retrieving;
- Section two: assessment of critical thinking capabilities through the Watson-Glaser Critical Thinking test;
- Section three: assessment of critical thinking capabilities through fake news detection capabilities;
- Section four: self-assessment of critical thinking capabilities.

The *Watson-Glaser Critical Thinking Appraisal* test used for section two is reputed a reliable source for the assessment of critical thinking [26]. The test encompasses five key areas, each one covered in the survey by three questions, to which respondents are required to answer with a multiple choice after having read a short text statement to which the questions are referred:

1. *Inference*: the section measures the capability to distinguish between true and false assertions;
2. *Recognize Assumptions*: the section measures the capability to identify assumptions underpinned in a specific text;
3. *Deduction*: the section measures the capability to deduce conclusions out a specific text;
4. *Interpretation*: the section measures the capability to identify acceptable conclusions out of a specific text statement;
5. *Evaluation of Arguments*: the section measures the capability to assess the validity and relevance of inductive reasoning based on a specific text statement.

We measured the capability of detecting fake news capabilities reporting two fake news circulating over the network based on plausible, but inaccurate, real-life events. Finally, we used a model from the literature to assess the behavioral traits of digital natives [13] to perform the self-assessment of critical thinking.

The survey has been administered anonymously through a public page on Facebook, and data were collected and analyzed anonymously. Participants were guided by online instructions on how to fill the survey and had the chance to opt out once started. Respondents were voluntary informed participants who agreed to share their responses with us. We collected 422 complete responses to the survey of millennials born in the period from 1982 to 2001 [12, 23, 27].

4 Data Analysis

This section describes the main results of the exploratory analysis of the data collected from the survey. The description focuses on the profile of the respondents first and the details on the answers collected by respondents using descriptive statistics.

4.1 *The Profile of Respondents*

Out of the 422 responses 67 were males (15.80%), and 357 were females (84.20%). Respondents age varied between 17 and 36, with an average of 22. Under this perspective, the sample is biased towards the major presence of women among respondents. Most of the respondents have a high education degree (71.23%), and one fifth a three-year bachelor's degree (21.46%). Only 7 participants (1.65%) declared only a high school degree, 22 (5.19%) a single-cycle or two-cycle degree and 2 (0.47%) a master's degree. This profile is in line with the general trend in the millennials generation, which is considered to be the most educated generation ever [28]. However, the presence of high education degrees among millennials in our sample is larger than the average of the generation: 71.23% in our sample against 54% of the millennials generation average [28].

Concerning their engagement with social media, 95.75% of respondents ($n = 406$) said to use WhatsApp every day, while only 2 (0.47%) never use it. Similar situation for the usage intensity of Facebook: 90.09% of the sample connects to the site every day and 6.84% more times a week, while less than 3% declared to use it seldom or not use it at all. The use of social media platforms other than WhatsApp and Facebook is instead less frequent. Only 52.12% ($n = 221$) of respondents declared a daily use of other social media, and a further 19.81% declared to use them several times a week.

On the other hand, as regards millennials' trend to obtain information from traditional sources, the context appears to be less homogeneous. While the use of social media in general (Facebook, WhatsApp, and other platforms) is diffused among the sample of Millennials, only 23.82% ($n = 101$) and 29.01% ($n = 123$) respectively declared to read newspaper articles (including those online) and watch TV news on a daily basis. On the other hand, the percentage of those who never resort to these information media is higher compared to that of the use of social media platforms: 6.60% ($n = 28$) for the former and 11.32% ($n = 48$) for the second. In general, we can say that about 60% of respondents tend to use these channels of information quite frequently, while about 25% use them seldom or not at all.

4.2 *Critical Thinking Skills: Descriptive Statistics*

The survey contained 15 questions, divided into five sections, to measure critical thinking skills with the Watson-Glaser critical thinking appraisal schema [26]. We measured the answers on the following scale: 0 points (wrong answer), 1 (correct answer). The maximum theoretical score for each section is 3. The maximum theoretical score for the 15 questions on critical thinking is 15.

In the first section, *Inference*, the average score was 1.21 (S.D. 0.94). Only 10.38% of the participants answered all the questions correctly, while 25.24% answered none.

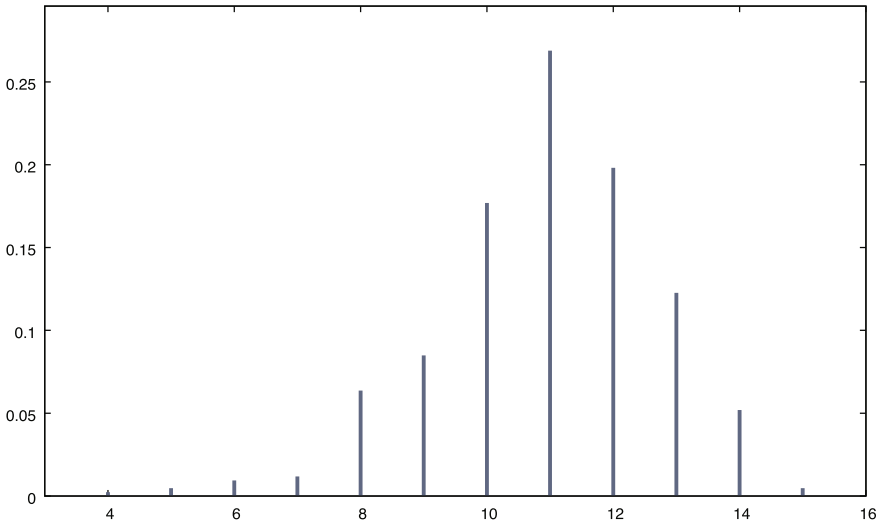


Fig. 1 Distribution of total score

The results of the second section, *Recognizing Assumptions*, are better. The average score was 2.40 (S.D. 0.68), and 50.71% of the respondents answered all the questions correctly. The scores of the third section, *Deduction*, were even higher, in which everyone answered at least one question, and 76.42% of the participants at all correctly. The average score was 2.73 (S.D. 0.52). In the fourth section, *Interpretation*, we found an average score of 2.62 (S.D. 0.63). In this case, only 0.71% of respondents could not answer the questions, while 69.81% completed them without errors. Finally, the *Evaluation of Arguments* section was completed only by 21.23% of participants, with an average score of 1.98 (S.D. 0.70).

Considering the five sections together, we note an average total score of 10.94 (S.D. 1.74) on a maximum of 15. The worst result (4) is only in one case, while two participants achieved the maximum score of 15. The modal score is 11, obtained from 26.89% of respondents ($n = 114$). Figure 1 shows the distribution of the total score.

To further assess the interviewees' critical thinking skills, we inserted into the survey two fake news based on events discussed by communication media during the period of administration of the survey. Concerning the first fake news, 63.92% ($n = 271$) recognized it as false, 28.77% said they did not know it, and only 7.31% ($n = 31$) believed it was real. The opposite happened for the second fake news: only 18.40% of the participants ($n = 78$) correctly stated it was false, while 62.74% ($n = 266$) considered it to be true. The remaining 18.87% could not evaluate the validity of the news.

We ask respondents to declare the reasons for their answers. Those who felt the news to be false reported to know the facts, to have other sources which proven the news fake, or reported inconsistencies in the information in the news. The respondents

who declared to ignore whether the news was true or false stated they were not sufficiently informed on the topic or declared to have not been able to find the original or related sources. Finally, who believed the news to be truly stated to have already read it or heard of it from sources reputed reliable. The second news, in some cases, was considered true by the “credible and logical” information it contained.

4.3 Self-assessment of Critical Thinking Skills

In the last part of the survey (four questions), we asked respondents to self-declare their critical thinking skills. The scores for the self-assessment were taken from a validated scale available in the literature [13] and ranged from a minimum value of 1 (completely disagree) to a maximum value of 5 (completely agree). The self-assessment encompassed the following set of questions:

- I am used to selecting information sources on the Internet and to judge their relevance (average score of 4.39, S.D. 0.73);
- It is easy for me to identify and avoid unreliable information sources on the Internet (average score of 3.88, S.D. 0.88);
- I never fall into the trap of considering as reliable an unreliable information source on the internet (average score of 3.65, S. D. 0.98);
- I think I am capable of assessing the reliability of information sources on the Internet (average score of 4.10, S. D. 0.74).

The theoretical total score on the self-assessed measure ranged from 4 (min) to 20 (max). Figure 2 shows the distribution of the total score. The distribution is skewed towards the higher value of the scale.

To analyze potential differences among the average scores in the different sections of the survey, we noted that in the overall, in Sections 3–7, men obtained a higher average score in respect of that of women (respectively of 11.03 and 10.92), although this difference is not statistically significant (p -value 0.65). Men also reported a higher self-assessment score: 17.18 compared to 15.8 (p -value 5.159). While about the recognition of fake news, results show no particular inequality.

Repeating the test after dividing the participants into two groups based on ages, 17–21 years ($n = 204$) and 22 to 36 ($n = 220$), the average score obtained in the evaluation of Critical Thinking is very similar, respectively 10.90 and 10.98 (p -value 0.657), to that obtained in the self-assessment: 15.90 and 16.12 (p -value 0.388). However, the second group turned out to be better able to recognize fake news (p -value $8.596e-5$).

Considering the differences regarding the degree we divided the interviewees into two groups: the first of those who have a middle school diploma or a higher school diploma ($n = 309$) and the second of those who have a university degree or a master ($n = 115$). We note that the latter obtained a higher average score in the analysis of Critical Thinking, 11.15 compared to 10.86 (p -value 0.136) and in the self-assessment, 16.27 compared to 15.93 (p -value 0.222). Moreover, they recognized the

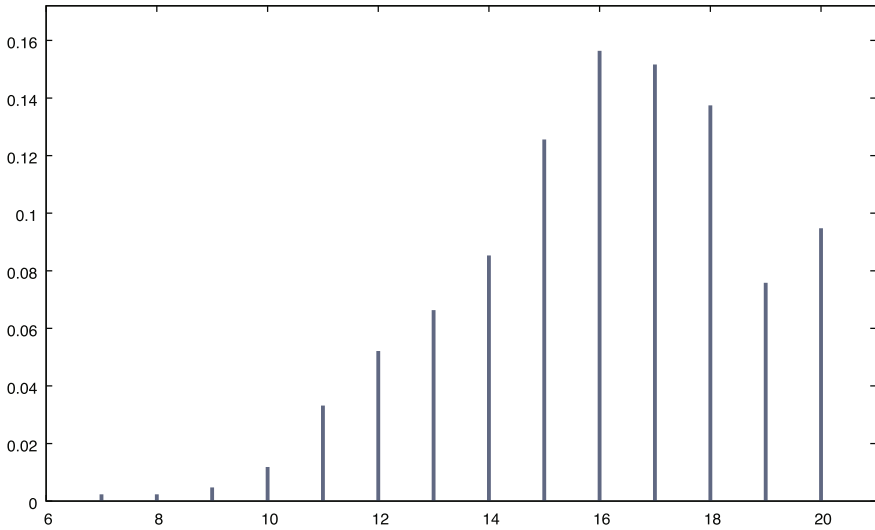


Fig. 2 Distribution of the total scores of the self-assessment of critical thinking skills

falsity of the news better (p -value 0.579). Through an ANOVA test, it is clear how the average score obtained in Critical Thinking increases with the increase of the qualification: 10.71 for the middle school diploma; 10.87 for the diploma; 11.11 for the three-year degree and 11.32 for the master's degree (p -value 0.638).

Going to analyze the differences due to the frequency of use of social media and information channels, through the ANOVA test, we note that: increasing use of Facebook is associated with an average descending score on Critical Thinking. From a maximum of 11.4 for those who do not use it ($n = 5$) to a minimum of 10.92 for those who use it every day ($n = 382$), with a non-significant p -value equal to 0.946. Instead, there are no particular inequalities between groups in recognizing fake news. Also, concerning the use of the others social media platforms, there are no significant differences between the various sub-groups.

Those who said they read newspapers or listen to news broadcasts more frequently (daily or several times a week) were better at recognizing fake news (p -value 0.13 in the first case and 0.185 in the second).

Finally, analyzing the relationship between the self-assessment of critical thinking made by the participants and the ability to recognize the falsity of the two news, we noted that those who obtained a score greater than 16/20, on average, were better than those who were attributed a score equal to or less than 16/20. The difference is not statistically significant (p -value 0.271).

4.4 Exploratory Analysis

Considering that almost no difference regarding averages among the groups defined over the variables in section one was statistically significant, and with the objective of further exploring the data, we run a cluster analysis to extract homogeneous groups within the dataset. The analysis was performed using a complete clustering analysis algorithm with the Wards, D2 method: Fig. 3 shows the resulting dendrogram. According to Fig. 3, and to the quality metrics we calculated, both a two and four clusters solutions are possible. We explored both and opted for a two clusters solution.

To understand the composition of the different groups, Table 1 show min and max value, the first and third quartile, median and mean of the data of the two clusters. The table is divided into two parts: the first part refers to cluster number one with 264 observations (right cluster in the dendrogram), while the second part refers to cluster number 2 with 158 observations.

The columns in Table 1 are to be interpreted as follows:

- wAp: Intensity of use of WhatsApp (min 1 – max 5)
- Fb: intensity of use of Facebook (min 1 – max 5)
- Sn: intensity of use of other Social Networking platforms (min 1 – max 5)
- Nws: intensity of use of traditional newspapers (min 1 – max 5)
- Tg: intensity of use of TV news programs (min 1 – max 5)
- Inf: Inference (min 0 – max 1)
- Asp: Assumption (min 0 – max 1)
- Ded: Deduction (min 0 – max 1)
- Int: Interpretation (min 0 – max 1)
- Arg: Arguments following (min 0 – max 1)

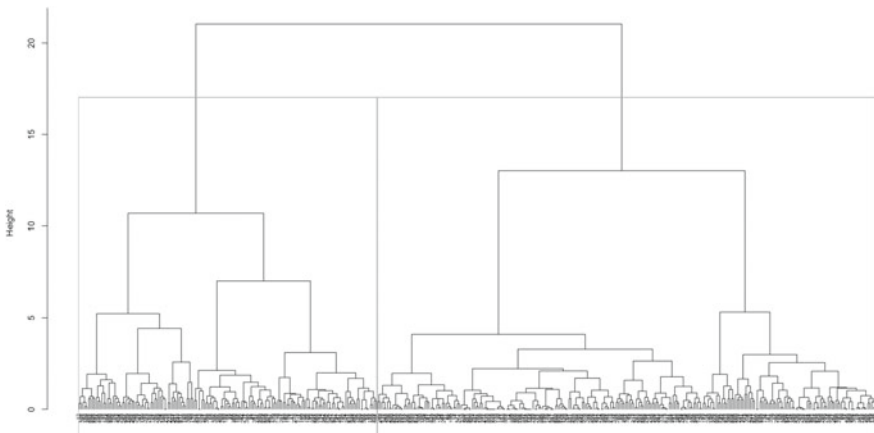


Fig. 3 Cluster dendrogram

Table 1 Description statistics of cluster data

		wAp	Fb	Sn	Nws	Tg	Inf	Asp	Ded	Int	Arg	sCri	Fake
264 obs	Min	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.33	0.00	0.00	0.35	0.67
	1Q	5.00	5.00	3.00	3.00	3.00	0.00	0.67	1.00	0.67	0.67	0.70	0.67
	Med	5.00	5.00	5.00	4.00	4.00	0.33	0.83	1.00	1.00	0.67	0.80	0.67
	Mean	4.94	4.85	3.92	3.63	3.54	0.38	0.81	0.92	0.88	0.66	0.80	0.74
	3Q	5.00	5.00	5.00	4.00	5.00	0.67	1.00	1.00	1.00	0.67	0.90	0.83
	Max	5.00	5.00	5.00	5.00	5.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
158 obs	Min	2.00	1.00	1.00	1.00	1.00	0.00	0.00	0.33	0.33	0.00	0.50	0.33
	1Q	5.00	5.00	3.00	3.00	3.00	0.33	0.67	0.67	0.67	0.67	0.75	0.33
	Med	5.00	5.00	4.00	4.00	4.00	0.33	1.00	1.00	1.00	0.67	0.80	0.50
	Mean	4.91	4.82	3.77	3.51	3.45	0.44	0.79	0.89	0.87	0.65	0.81	0.50
	3Q	5.00	5.00	5.00	4.00	4.00	0.67	1.00	1.00	1.00	0.67	0.90	0.50
	Max	5.00	5.00	5.00	5.00	5.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83

- sCri: self-perception of critical thinking (min 0 – max 1)
- Fake: detection of fake news (min 0 – max 1).

The column from wAp to Tg represent behavioral data on the main sources of information used by the respondents. The columns from Inf to Arg represent the five dimensions of the Watson Glaser survey. The column sCri represent the self-assessment of critical thinking assessed with the dimension in the scale provided by [13], while the column Fake represent the capability of detecting fake news measured by the judgment formulated by respondents on the truthfulness of a two fake news.

The data on the habits of information acquisition do not show significant differences among the samples. Both groups are intense users of Facebook and WhatsApp. The first group differs from the second as the usage of other social networking platform is more diffused. The intensity of use of traditional newspaper and TV daily news is lower than the usage of social media in both groups, and this is consistent with the profile close to that of digital natives that respondents show [29].

Concerning the critical thinking skills measured by the Watson Glaser instrument, both groups show low average scores for the inference and evaluation of arguments dimensions. The average scores of the remaining dimensions are all quite high and not so differentiated between the two groups.

Where the two groups differ is on the comparison between the self-perceived critical thinking skill and the capability to detect fake news. The self-perceived critical thinking skill is equally high for both groups. Consequently, the capability to detect fake news is consistently lower than the self-perceived capability of critical thinking, still in both cases. However, groups two shows lower scores on the capability to detect fake news and marks a larger difference between the self and the actual critical thinking capability.

5 Discussion

The analysis of the data shows three aspects to discuss: critical thinking scores, differences between measured and self-assessed critical thinking, and sample homogeneity.

Concerning the results on critical thinking, the analysis potentially disputes the claims from the literature [9, 15] on the lack of critical thinking by millennials. The scores on the Watson-Glaser instrument reported by the millennials are on average not low, if not for the inference (particularly) and evaluation of arguments dimensions. Adding to this, we need to mention also the capability of detecting fake news which, though higher than one might expect, at least for the second cluster affects 50% of the millennials. This statement seems to suggest that, though millennials are capable of interpreting and deducing information, and recognizing assumptions in it, they are weak in identify true and false assertions—and the capability to detect fake news confirms that—and in assessing the validity and relevance of inductive reasoning based on information.

Concerning the differences between the measured and self-assessed critical thinking skills, the study shows that, when we measure it by the capability to detect fake news, the perceived critical thinking skills are on average greater than the actual ones in the investigated group of millennials. The statement also holds for the dimensions of inference and evaluation of arguments. In a way, this result is expected since the self-assessment of critical thinking skills might be affected by individual biases [13].

The third aspect concerns the homogeneity of the sample. The literature warns on treating millennials as a homogeneous cohort of individuals all showing the same traits [9]. Empirical sources also identified significant internal differentiation among the characteristics of the millennials [8]. However, looking at the analysis of the data sample we collected we are not in the position to confirm such statement, as the data show in our case a higher level of homogeneity. Out of the two cluster solutions found indeed, individuals belonging to them differ only by little details.

Finally, no significant evidence emerge from the adoption of social media or traditional media as the source of information of millennials as, also from this perspective, the respondents do not show differences about the usage of social media.

6 Conclusions

This paper presents the results of an exploratory analysis on a sample of 422 responses from millennials to a survey designed to assess the critical skills capabilities of respondents. The results of the exploratory study show that—among the dimensions of critical thinking—millennials are weak regarding making inferences out of data and information, evaluate arguments, and identify fake news. Given that the intensity of use of social media among the other information sources is similar for the

two groups of millennials analyzed, the study revealed no differences regarding the influence of social media on critical thinking.

As mentioned in the paper, the sample analyzed is biased towards the presence of female among the group of millennials. Respondents of our sample also show a higher level of education compared to the average of millennials. As a limitation, we have to acknowledge that the differences among means in the groups could be affected by these biases. Adding to this, we also acknowledge that the use of Facebook for the formation of the incidental sample might have contributed to the lack of diversity in it. For this reason, we retain this analysis exploratory, and we make no inferences. In future research, we will collect further data balancing the representativeness of the sample from the sex point of view and use different channels for the selection of respondents.

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