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Epistemic vs Non-Epistemic Criteria to Assess Wikipedia Articles: Evolution of Young People Perceptions

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Abstract. This paper tackles the problem of information credibility assessment by users, focusing on Wikipedia articles. We consider both epistemic and non-epistemic criteria. We conducted a study using a questionnaire where 841 French young people aged from 11 to 25 years participated and we analysed the results considering the level of education as a variable. We found that the higher the level of education is, the more young people mention epistemic credibility criteria and the less they indicate non-epistemic criteria. We draw some recommendation for information literacy.

Keywords: Wikipedia, credibility judgment, education level, student, teaching information literacy.

1 Introduction

Studying the judgments of information credibility became crucial because of the recent information landscape transformation. Indeed, the individuals are confronted with information of uneven quality not only on the Web but also on specific sources such as Wikipedia. With regard to teaching information literacy, the study of young people's perception of credibility is of particular importance. Many studies have shown that Wikipedia is an information source that the majority of the young people use frequently, although they do not consider it as the most reliable source and in spite of the its predominantly negative academic reputation (for a recent synthesis, see [1]). However, many questions remain unsettled on the credibility criteria young people adopt when considering articles from the collaborative encyclopaedia, as well as the influence of the age and level of education on the perception of the credibility.

In this paper, we focus on analysing credibility of Wikipedia articles considering a large range of education levels in France, from Collège (middle school), that is to say where pupils are 11-12 years old, to Master where the majority of students are aged 22-25 years. Our study focuses on (1) the main criteria the young people mention to assess credibility of Wikipedia articles, and (2) the variation of the mentioned criteria over the education levels.

2 Credibility Judgement Young People Mention

2.1 Epistemic vs Non-Epistemic Criteria

There are various definitions of the term "credibility" [2]. We proposed to define credibility as a characteristic granted to information depending on its truth-value [3]. Past studies show that there are a large number of criteria used to judge the credibility of information [4]. In this present work, we distinguish two types of credibility criteria: epistemic criteria and non-epistemic criteria. Epistemic criteria have a direct bearing on the truth value of the information. They concern trustworthiness and expertise of the source as well as trustworthiness and expertise of the content [2, 4]. The conclusions of empirical studies on the use of epistemic criteria by young people are not converging. For example, some studies show that young people take into account epistemic criteria as they consider the authority of the source when they search and select information [5, 6]. On the other hand, it has been shown that young people have difficulty understanding epistemic criteria [7] or applying them when seeking information [8].

Research also shows that users refer to non-epistemic criteria to determine the credibility of the information. These criteria relate in particular to the form of the document. In the case of the web, the appearance of the site (e.g. visual design, typography, presence of images, colours) and its structure (organization of the information, ease of navigation) frequently influence users' judgments of credibility [9]. The importance of web site aesthetics on credibility has been noted as an important criterion for high school students [10] and for undergraduate students [11]. The

influence of the amount of information on the perception of credibility has also been demonstrated. In a study considering young people aged 4 to 18, abundant information was frequently considered as synonymous to "good information" [12].

2.2 Influence of Age on the Judgments of Credibility

Perceptions and criteria regarding information credibility are not identical among young people. There are many psychological, cognitive, social and contextual variables that can explain these differences [13]. The age and level of education are two of them.

The role of the age is recognised on a theoretical point of view [14] but there is little empirical research on the topic. A study concerning young people 11-18-years old, shows that the older individuals are more conscious of the credibility problem when using on-line information. They use more credibility criteria and are less inclined to believe hoaxes than the younger children [15]. Other authors noted differences between 1st and 3rd-year undergraduate students when considering the factors that influence their credibility judgment of on-line health information [16]. The 3rd-year students referred to more criteria and were much clearer about their evaluation processes. Variations between the information behaviour of Bachelor's and Master's degree students were also observed. Liu and Huang observed that Bachelor's degree students use primarily the author's name, reputation, institutional affiliation, and web site reputation to evaluate information credibility [17]. On the other hand, Master's degree students are more concerned with the accuracy and quality of information, while they are less concerned with the source-related features.

According to these studies, it seems that the young people pay more attention to the problems of credibility and refer more to epistemic criteria as they grow up. However, it is difficult to go further in the analysis, because of the lack of an actual comparison according to the level of education that considers the same source of information.

2.3 Credibility Criteria on Wikipedia Articles

Because of its collective and iterative writing process, Wikipedia contains articles that are heterogeneous both in terms of their level of completion and accuracy. While reading articles, it is possible to evaluate them by considering different criteria. Several empirical studies have begun to identify the criteria and procedures readers use for evaluating Wikipedia articles.

Yaari et al. studied the assessment of Hebrew Wikipedia articles by Bachelor's and Master's degree students [18]. For these authors, the credibility of an article is related to non-measurable criteria (such as the article coverage or its structure) and measurable criteria (such as the article length or the presence of external links). Considering the same issue, Lim and Simon interviewed undergraduate students who said they rely primarily on the article length, its table of contents, and the associated references in order to assess the information credibility [19]. They also state they use the warning banner and identify - or click through - external links.

Some of these criteria were also mentioned in a research conducted with students with an average age of 23 years [20]. The results indicate that credibility of Wikipedia articles is drawn from the text itself -essentially its accuracy, completeness, and length- the references it provides and, to a lesser degree, on the presence of images in the article. Rowley and Johnson' study only partially confirms these results on fifty Bachelor's and Master's degree students [21]. The references at the end of the article correspond to the credibility criterion participants mentioned the most often, followed up by mentioning the article references are not enough that incites mistrust. Unlike previous studies, the article length is not considered. Lim confirms that the credibility of a Wikipedia article is correlated to the amount of references regardless to the level of knowledge students have on the article topic [22].

These results can be reconsidered in the light of the distinction made between epistemic and non-epistemic credibility criteria. The epistemic criteria mentioned in these studies are related to the article contents (e.g. their accuracy). When considering the source, determining the expertise and the trustworthiness of the author is difficult because of the collective character of the edition and the frequent anonymity of the contributors. In the editorial model of Wikipedia, the references are thought to guarantee the credibility of the information. The references counterbalance the uncertainty on the expertise and the trustworthiness of the contributors. Indeed, source reference is an essential rule and a very important practice for the Wikipedia community [23, 3]. In our research, we also noticed that the young people mention non-epistemic criteria to establish the credibility of Wikipedia articles such as the length of the article, the presence of images or the presence of a table of contents.

3 Research Questions

From the literature review, we can conclude that criteria used by readers to assess credibility of Wikipedia articles do not fully converge. We also note that all the studies we found concern students at the university level only but do not consider younger people. For these reasons, it is appropriate to question to what extent the conclusions from the literature can be transposed to secondary-schools (from 11-12 years old pupils to 17-18 years old students). Since Wikipedia is a source known and used by a very large majority of the young people frequenting the secondary education and university, we can compare the perceptions of the credibility of articles according to the various levels of education. It is then possible to apprehend the evolution related to the epistemic and non-epistemic criteria mentioned by young people of different ages. If we refer to the research on the judgments of credibility of the young people, we could propose that the importance of epistemic criteria rises with advances in academic levels. But the research on the credibility of Wikipedia articles we mentioned above shows that students of Bachelor or Master's degree also refer to non-epistemic criteria.

In this paper, we also question the main criteria for assessing Wikipedia articles as follows: **Q1** What are the criteria young people consider as essential to evaluate a Wikipedia article? **Q2** Does the importance of different criteria evolve with educational

level?

4 Methodology

The unpublished results presented in this paper arise from a survey using an on-line questionnaire realized in France. We obtained the answers of 841 young people aged from 11 to 25 years. The group contains 54.1 % of females. 256 pupils are middle school (Collège in French) (from 11 to 15 years old), 265 in high school (Lycée in French) (from 16 to 18-19 years old), 148 in Bachelor's degree (from 18-19 to 21-22 years old), 172 in Master's degree (from 22 to 25 years old). The questionnaire contained 39 questions related to the socio-demographic details of the participants, to the use of Wikipedia and the perceptions of Wikipedia. In this paper, we present only the results related to the credibility of articles (for the other results and a thorough presentation of the methodology, see [1]). Young people had to answer the following closed-ended question "*Why makes a Wikipedia article credible?*]" by selecting one on several criteria among the following: *It is long ; There are some photos in it ; it contains information which seems accurate to me ; there are no mispellings ; there is a table of contents ; it is well presented ; sources are cited ; the sources it cites seem of good quality to me ; other (please detail)*.

For each of the questions, a yes/no choice was asked. Epistemic and non-epistemic criteria were not distinguished in the questionnaire.

We filtered out the answers which were obviously not serious ones (considering some open questions we asked). The questionnaire was "supervised" by the teachers or school librarians and was to be filled in online by the participants.

Our main goal was to examine whether the frequency of certain criteria to estimate credibility of Wikipedia articles change with the education level. We also used descriptive statistics and ANOVA to analyse the collected data. ANOVA was chosen because it allows identifying significant differences among groups, in our case among participants from four groups: Collège, Lycée, Bachelor and Master levels. We applied the Tukey's test and report the p-value associated to ANOVA as well.

5 Results

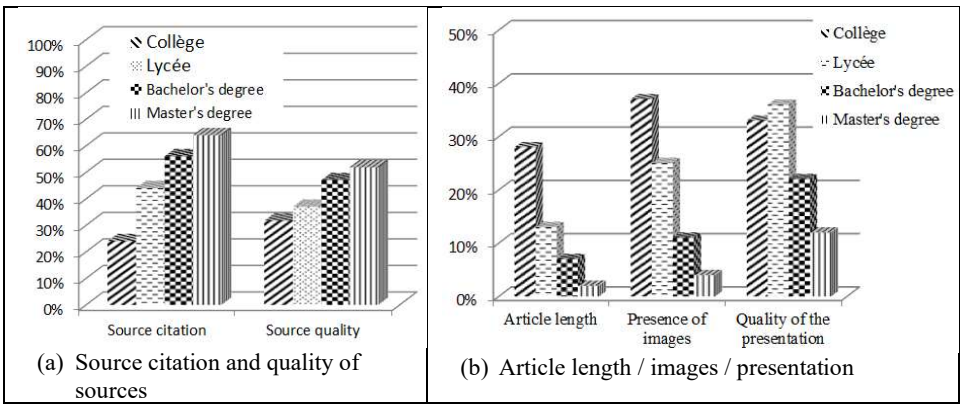
5.1 Frequency of Criteria Related to Assess Credibility of Wikipedia Articles

The criterion reported the most by respondents is accuracy of the content (46%). From their responses, we also see a strong propensity to mention the presence of references (44%) and the quality of the cited sources (40%). These three first criteria are epistemic. However non-epistemic criteria are also quoted as the quality of the presentation (28%), correctness of spelling (25%), presence of images (22%), presence of table of content (21%), and article length (15%).

5.2 Evolution of Credibility Criteria According to the Level of Education

One criteria of credibility (correctness of spelling) doesn't evolve according to the level of education, while two of them (the presence of table of content, accuracy of the content) evolve only slightly. In this section, we focus on the criteria that evolve the most as presented in Figure 1.

Using ANOVA, we found significant differences within the entire sample for sources citation ($p < 0.001$ ***, $F = 26.3$), citing quality sources ($p < 0.001$ ***, $F = 6.9$), the length of the article ($p < 0.001$ ***, $F = 23.2$), the presence of images ($p < 0.001$ ***, $F = 25.2$), the quality of presentation ($p < 0.001$ ***, $F = 11.1$). The use of descriptive statistics as well as the Tukey test show significant differences according to the level of education.



(a) Source citation and quality of sources

(b) Article length / images / presentation

Fig. 1. Credibility criteria of Wikipedia articles

Firstly, we can note a clear increase in credibility related to *source citation*; this criterion becomes the main one for Master's degree students (see Figure 1a). Collège pupil group is different from other groups (significant difference with p-value < 0.001 ***). The difference between Lycée and undergraduate students cannot be considered as significant ($p > 0.05$). However, this difference is significant between Lycée and Master's degree students ($p < 0.001$ ***) but not between the Bachelor's and Master's degree students ($p > 0.05$).

We note a similar evolution on the criterion related to the *quality of sources* that are cited in the Wikipedia article (See Figure 1a). Its frequency increases with the level of education but less sharply than the source citation criterion we analysed in the previous paragraph since only 52% of Master's degree students mentioned it. Collège pupils significantly differ from Bachelor's degree students ($p < 0.05$ *) and from Master's degree students ($p < 0.001$ ***) but not from Lycée students ($p > 0.05$). Lycée students differ only from Master's degree students ($p < 0.05$ *). There is no significant difference between Bachelor and Master's degree students ($p > 0.05$).

The *article length* criterion has also significant variations. The frequency in which this criterion is mentioned tends to decrease throughout education level (see Figure 1b).

Again, Collège pupils are different from other groups ($p < 0.001$ ***). Other levels are not significantly different ($p > 0.05$) apart between Lycée and Master's degree students ($p = 0.053$). Credibility attributed to the *presence of images* in an article also tends to decrease with the progress in academic curriculum (see Figure 1b). It is mentioned as an important criterion by more than a third of Collège pupils, a quarter of Lycée students and less than two undergraduate students out of ten. According to ANOVA, the Collège and Lycée students clearly differ from Bachelor and Master's degree students ($p < 0.001$ ***) who have similar profiles regarding this variable ($p > 0.05$). The *quality of the presentation* of an article plays a role in credibility judgment for more than one out of three participants for Collège or Lycée but much less after (see Figure. 1b). Collège pupils and Lycée students answered similarly given this formal criteria ($p > 0.05$). Students after Lycée do not significantly differ according to their level. The answers given by Master's degree students are clearly distinct from Collège pupils and Lycée students ($p < 0.001$ *** in both cases).

6 Discussion

The criterion to estimate trustworthiness of a Wikipedia article mentioned the most frequently by the survey participants is the information accuracy. This criterion was also given as a crucial feature in Lucassen and Schraagen' study [20]. We found this criterion is important whatever the level of education is. One possible reason is that this criterion is both easy to understand at any age and that credibility is often considered the same as information accuracy. The observation on the importance of the sources' citation converges with the results from the literature since we noted that this criterion was given unanimously as important to estimate the credibility of Wikipedia articles. However, the quality of the cited sources is mentioned at a surprisingly high frequency (40%) when compared to previous studies where it is not considered as an essential criterion.

The most interesting result is found in the variations of criteria for estimating credibility of Wikipedia articles among the different academic levels. The importance that is given to non-epistemic criteria decreases with the advance in the academic curriculum. According to ANOVA, cuts occur at different levels of education (Collège / other levels for the article length, Master / other groups for the quality of the presentation, Lycée / University for the presence of images).

Some parallels can be made with other studies related to information assessment. The relative importance the young people give to Wikipedia articles' length can be compared to some results produced in a more general context. According to Shenton and Dixon, considering 4 to 18 years old participants, the amount of information provided by a source indicates its quality for the youngest while this is not always the case for older participants [12]. We notice a similar evolution when considering the article length criteria over the progress in education.

In our survey, more than a third of Collège pupils and a quarter of Lycée students said they rely on the presence of images to give credit to Wikipedia articles while far

fewer university students mentioned this criteria. Other studies have shown the important role images play in the information assessment process for high school students [24]. We can hypothesise that when they become older, the young use less visual elements to evaluate information [25] and that they focus more on epistemic criteria.

Conversely, we found that the young pay increasing attention to source citation and to the quality of the cited source with the progress in their academic curriculum. Young people can be aware of the importance of references in Wikipedia simply by using the encyclopaedia regularly. Doing so, they are used to the rhetoric structure of Wikipedia articles many of which include a bibliography section. When this is not the case, bands warn the readers about the lack of source citation, which implies implicitly that a good article should include references. According to this point of view, Wikipedia experience accumulated over the years would be formative in that it would contribute to orienting readers' assessment criteria. We should also mention the role of the educational institution. During their education, young people are gradually asked to perform academic tasks involving the provision of information accompanied by a bibliography. They are exposed to teachers' injunctions requiring them to cite their sources and this can influence the way they conceive the evaluation of credibility [26]

The higher the level of education, the more young people mention epistemic credibility criteria and the less they indicate non-epistemic criteria. This may show a specificity of the attitude toward Wikipedia. Other results from the same survey (see [1] for details) indicate that the more they advance in education level, the more suspicious young people are about the use of Wikipedia for academic purposes and the more they are sensitive to the mostly negative reputation of this source among teachers. Increasing attention to source citation and to their quality can be seen as a way to compensate for the perceived unreliability of the collaborative encyclopaedia. However, the growing attention to epistemic criteria may also be a more general cognitive evolution of young people. As noted above, research on young people's information assessment suggests that age is associated with increased attention to credibility issues and the use of more specific, accurate and more appropriate criteria. The results of this survey confirm this evolution.

6 Limitations of the Study and Future Research

A questionnaire provides declarative data and has the advantage of quantifying them in order to compare them, as for example in this study according to educational levels.

The data presented in this article reflects the students' responses about the means used to judge the credibility of articles. These representations are important because they reflect the students' knowledge on the subject and can influence evaluation practices. A student who is not aware that the references can be useful to assess the credibility of a Wikipedia article will not use them for this purpose. On the other hand, there may be a significant gap between representations and actual evaluation practices. It would therefore be necessary to use other methods, such as observation or think

aloud, to identify the evaluation of methods used by young people from Collège to Master's degree.

In this article, we have observed the evolution of epistemic / non-epistemic criteria as the school curriculum progresses. However, we should not forget that many young people do not go to higher education. It would therefore be necessary to analyse also the perceptions of these young people. This study would make it possible to distinguish more clearly the effect of age from that of the level of education.

Finally, it would be interesting to examine whether we find similar evolutions in the frequency of epistemic and non-epistemic criteria according to the level of education and age to evaluate the credibility of other types of sources than Wikipedia. Similar work could also be engaged on Youtube or Twitter where the credibility indices are partly different.

7 About Teaching Information Literacy

In educational studies, there is a consensus that teachers should take into account students' prior knowledge and practices in their teaching strategies [27]. This principle is particularly important in the field of information literacy because tools and sources of information such as Google, Wikipedia and digital social networks are used frequently in everyday life. The study we present shows that only a minority of Collège and Lycée students are aware of the existence of appropriate epistemic criteria to evaluate the credibility of Wikipedia articles (citing sources, quality of sources cited). The study also shows that a significant proportion of these students mention non-epistemic criteria that do not seem the most appropriate to assess information credibility (length of the article, presence of the image, quality of the presentation). Even at the university level, a few students mentioned these criteria. These results indicate a confusion for students around the perception of credibility and the means to determine it. Our study thus reinforces the idea of the need for education on the evaluation of the credibility of information at the various levels of education.

Gradual training at the collège and lycée could help students become aware of their practices, distinguish more clearly the most appropriate criteria for determining information credibility, and understand how credibility is built into Wikipedia. It is essential to encourage young people to move from overall assessment of Wikipedia - partly based on its reputation – to a more objectified and precise assessment of a given Wikipedia article and piece of information it covers.

This training can enable them to take advantage of this resource. The study of the role of references in Wikipedia is also the way for them to understand the reasons and importance for source citation in general, all the more so as the students have to cite their sources in their academic productions. Moreover, bringing students' attention to the references of Wikipedia articles also has the advantage of showing that they have at their disposal potentially usable sources on the topic of interest. This seems important because students tend to neglect these resources [28]. In addition, a pedagogical approach with regard to the sources cited in the articles can help to initiate or reinforce

the distinction of sources according to their degree of reliability, whether in secondary or higher education. Thus, Wikipedia can be seen as an educational mean which is relevant in an information literacy curriculum.

8 Conclusion

We found that the frequency of credibility criteria young people mention varies according to the education level. The criteria associated with formal characteristics and information quantity, are mentioned less as education level increases. Conversely, young people reported they pay increasing attention to source citation as they progress through their academic curriculum. In other words, we found that epistemic criteria increase with age while non-epistemic decrease.

Training young people from the college level (middle school) could bring them to have a critical view on their practices and to distinguish the most relevant criteria to assess information credibility. The knowledge on how credibility is considered in the collaborative encyclopaedia can be a mean to teach credibility criteria in a broader way.

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