

SKILLS FOR CRITICAL EVALUATION OF INTERNET INFORMATION AMONG HEALTHCARE STUDENTS

Angelina G. Kirkova-Bogdanova

Department of Medical Informatics, Biostatistics and E-learning, Faculty of Public Health, Medical
University – Plovdiv, Bulgaria, angelina.kirkova@mu-plovdiv.bg

Abstract: The ability to critically evaluate online information is crucial for academic success and lifelong learning, influencing how students structure arguments and integrate new knowledge. The research paper focuses on healthcare students' critical evaluation skills of internet information. The study utilized a self-reported questionnaire to assess healthcare students' abilities, revealing a lack of skills in evaluating web resources. The assessment tool developed for the study was validated and found to have a high level of internal consistency. The mean score of students for critical evaluation of web information was 34.61 with a standard deviation of 7.895, and the scores varied between a minimum of 14 and a maximum of 54. No statistically significant differences were found in the scores based on students' gender, year of study, or age. The findings suggest a critical need for ongoing development and implementation of targeted educational interventions to enhance students' ability to evaluate web resources effectively in the digital age.

Keywords: healthcare students, web information evaluation, assessment

1. INTRODUCTION

With the launge of the WWW, the culture of information consumption has changed dramatically. Today, we can access information from all over the world with one click. The good thing is that the internet is a free forum where anyone can share. This freedom, however, places demands on users, perhaps the most important of which is the awareness that information found on the web can be false, misleading and unreliable. In the era of emerging artificial intelligence this is crucial, keeping in mind the realistic feedback from AI and their tendency to give wrong but convincing answers when not trained enough on a subject. For higher education students, whose learning process is tied to searching for information on the Internet, the ability to critically assess the quality of the information found is crucial.

The Internet, while a rich resource, contains a vast amount of incomplete, contradictory, erroneous, and biased information, making it essential for students to develop critical evaluation skills to discern credible sources from unreliable ones (Molerov, et al., 2020). The ability to critically evaluate online information is not only vital for academic success but also for lifelong learning, as it influences how students structure their arguments and integrate new knowledge into their existing frameworks (Cárdenas Ruiz, Cifuentes Muñoz, Garzón Zea, & Rubiano Barriga, 2012). Tools like the EVON (evaluation of online information) test have been developed to assess students' skills in evaluating the relevance and credibility of online information, demonstrating the importance of these competencies in academic settings (Hahnel, Eichmann, & Goldhammer, 2020). Moreover, the quality of teaching and learning in higher education can be enhanced through data mining techniques that analyze educational data, further emphasizing the need for students to effectively evaluate information to improve their academic performance and overall educational experience (Chen, 2022). The development of frameworks such as Critical Online Reasoning (COR) highlights the necessity of equipping students with the ability to acquire, evaluate, and reason based on online information, ensuring they can navigate the complexities of the digital information landscape effectively (Molerov, et al., 2020). As students' reliance on the Internet grows, the ability to critically assess online information becomes indispensable for their academic and professional success, making it a key focus in higher education curricula (Zlatkin-Troitschanskaia, Hartigb, Goldhammer, & Krstev, 2021).

Evaluating information from the Internet involves several critical aspects, including the credibility, relevance, and quality of the information. Verifying the credibility of online sources involves a multifaceted approach that includes both manual and automated processes. Scholars emphasize the importance of evaluating several aspects such as the language used and the searcher's willingness to identify quality information, which can be challenging due to the vast amount of unfiltered data available online (Tuzahra, 2021).

Credibility is often assessed by examining the authorship and credentials of the content creators, as well as the presence of certifications and adherence to benchmarks set by reputable organizations (Kanmaz & Buduneli, 2021). Considering an author's expertise is crucial for several reasons. Firstly, it ensures the credibility and reliability of the research, as authors with relevant expertise are more likely to produce accurate and insightful findings. For instance, the study by Mishra et al. highlights that authors contribute a wide range of intellectual efforts, and their past experience and knowledge significantly impact the quality of the research (Mishra, Fegley, Diesner, & Torvik,

2018). Additionally, expertise modeling, as discussed by Lang, involves comparing an author's output with a reference model to estimate their knowledge in a specific domain, which can help in assessing the depth and breadth of their expertise (Lapšanský & Lang, 2022). Understanding an author's expertise not only enhances the trustworthiness of the research but also ensures that the study is grounded in a solid foundation of relevant knowledge and experience, thereby contributing to the advancement of the field.

Relevance is determined by how well the information meets the specific needs of the user, which can be influenced by the user's cognitive skills and reading abilities, as demonstrated by the EVON test that evaluates university students' ability to select the most relevant and credible links in a simulated search engine environment (Hahnel, Eichmann, & Goldhammer, 2020).

Quality is another crucial aspect, often measured using tools like the DISCERN instrument, which assesses the reliability and quality of consumer health information (Kanmaz & Buduneli, 2021). Additionally, the layout and design of websites, including the presence of distracting graphics and search facilities, can impact the user experience and the perceived quality of the information (Miller, Ward, Yoganantham, & Bond, 2021).

Trust in the information is also a significant factor, as it influences patients' decisions and their post-treatment assessments of healthcare providers, highlighting the need for quality control and public trust-building measures in digital healthcare (Vuong, Le, La, & Nguyen, 2022). Furthermore, the evaluation criteria used by students and professors in academic settings, such as the history of life and personal beliefs, also play a role in how information is assessed and utilized for learning purposes (Cárdenas Ruiz, Cifuentes Muñoz, Garzón Zea, & Rubiano Barriga, 2012).

A comprehensive evaluation of Internet information requires a multifaceted approach that considers credibility, relevance, quality, and trust to ensure informed decision-making and effective learning outcomes.

The research question we posed was whether healthcare students critically evaluate the information they find on the internet. The aim of the study was to investigate whether the students are aware of and apply criteria for assessing internet information. By understanding the students' level of comprehension and attitude toward critically appraising the quality of web information, we can provide appropriate training to address any potential shortcomings. Our initial goal was to create a tool to assess students' skills for evaluation of internet information in the native language of our target group, as no such tool existed for them.

2. METHODS AND PARTICIPANTS

The study took place in November and December 2024 and involved healthcare students from the Medical College and the Faculty of Public Health at the Medical University in Plovdiv. Two hundred students were given an anonymous self-reported assessment questionnaire specifically designed and validated for this study. The research was conducted in two stages: first, the assessment tool was validated, and then the students' skills in critically appraising web information were evaluated.

The survey instrument initially consisted of 16 sentences expressing desired or correct behaviour for evaluating web information. Students were asked to respond using a Likert scale where 1 corresponds to “never”, 2 – “sometimes”, 3 – “often”, 4 – “always”. Three independent variables were included – gender, age and year of study.

We utilized the test-retest method to validate the tool. We administered the questionnaire twice to 50 students with a two-week interval. Subsequently, we compared the results from the first and second administrations using the Paired Samples T-test. Following this, we excluded items with statistically significant differences in means and items with weak correlations. The internal consistency of the scale was assessed using Cronbach's alpha.

For analyzing scale data with a normal distribution (Score), we employed the Independent Samples T-Test and One-Way ANOVA parametric tests. Additionally, we calculated the Spearman correlation between scale data that do not adhere to a normal distribution (Age) and scale data with a normal distribution (Score).

We accepted a level of significance $\alpha=0.05$. The results are presented by a mean value (M) and a standard deviation (SD). IBM SPSS v.19 was used for statistical analyses.

3. RESULTS

A. Validation of the assessment tool

We received 41 pairs of correctly filled twice questionnaires. The results of the Paired Samples T-Test are presented in Table 1 and Table 2.

Table 1. Paired samples correlations

Pairs	N	Correlation	P
1_1 & 1_2	40	0,926	0,000
2_1 & 2_2	39	0,448	0,004
3_1 & 3_2	41	0,508	0,001
4_1 & 4_2	40	0,597	0,000
5_1 & 5_2	37	0,282	0,090
6_1 & 6_2	38	0,603	0,000
7_1 & 7_2	39	0,644	0,000
8_1 & 8_2	40	0,495	0,001
9_1 & 9_2	38	0,466	0,003
10_1 & 10_2	40	0,638	0,000
11_1 & 11_2	39	0,857	0,000
12_1 & 12_2	39	0,584	0,000
13_1 & 13_2	40	0,538	0,000
14_1 & 14_2	40	0,207	0,199
15_1 & 15_2	38	0,630	0,000
16_1 & 16_2	37	0,520	0,001

Source: Author

Table 2. Paired samples T-test

Pairs	Paired Differences		P
	M	SD	
1_1 - 1_2	-0,025	0,276	0,570
2_1 - 2_2	-0,282	1,025	0,094
3_1 - 3_2	0,171	0,998	0,280
4_1 - 4_2	0,150	0,893	0,295
5_1 - 5_2	0,162	1,014	0,337
6_1 - 6_2	-0,132	0,811	0,324
7_1 - 7_2	-0,231	0,777	0,071
8_1 - 8_2	-0,025	1,000	0,875
9_1 - 9_2	0,000	0,771	1,000
10_1 - 10_2	-0,175	0,747	0,147
11_1 - 11_2	-0,154	0,587	0,110
12_1 - 12_2	0,103	0,882	0,472
13_1 - 13_2	-0,150	0,864	0,279
14_1 - 14_2	-0,050	1,085	0,772
15_1 - 15_2	0,053	0,837	0,700
16_1 - 16_2	-0,135	1,004	0,419

Source: Author

All items met the criteria for equality of the mean. Not all items though had statistically significant moderate to high positive correlation. Items 5_1 & 5_2 and 14_1 & 14_2 did not meet this condition and we removed them from the assessment tool. With this final number of indicators, the lowest score of the scale is 14 and the highest – 14*4=56.

B. Students' skills for critical evaluation of web information

The number of students who responded was 166. Of them 113 (68.07%) were female, 43 (25.90%) – male, and 10 (6.02%) did not answer. The mean age of the sample was 23.03±7.335 years. First-year students were majority – 83

(50.00%), followed by third-year students – 42 (25.30%). Second-year students were 30 (18.07%) and 11 (6.63%) did not answer to this question.

Since the value of the Cronbach Alpha depends on the sample size, we estimated it on this stage of the research and received $\alpha=0.844$ with no item that will increase the value of deleted. This value indicates a high level of internal consistency of the questionnaire. We accepted the developed assessment tool as valid and reliable. The estimated score was 34.61 ± 7.895 , $N=157$. The score of the students varied between minimum 14 and maximum 54. We did not find statistically significant difference in the score, determined by the students' gender or year of study. No statistically significant correlation was found between age and score. The results from the assessment by indicators are presented in Table 3.

Table 3. Assessment of the students' skills for critical evaluation of web information

Indicators	N	M	SD
I think about the accuracy of the information I get from the internet.	165	2,96	0,956
I pay attention to the domain of the site (.bg; .com .net, etc.).	164	2,35	1,013
I check the site name in the URL (eg the highlighted www.mu-plovdiv.bg)	165	2,58	1,082
I verify the city's credibility (About us; Contacts, etc.).	164	2,54	1,030
I trust sites of reputable institutions.	165	2,61	1,004
I look for named authors of articles/materials.	166	2,16	0,980
I check for publication or update dates.	166	2,66	1,088
I seek additional information about the author online.	166	1,98	0,927
I verify if the material has sources/references.	166	2,28	0,957
I ensure sources are properly described and cited.	165	2,18	1,070
I check for any distortion of cited information.	163	2,31	1,062
I verify if the links in the material are functional and where they lead.	166	2,43	0,981
I pay attention to style, grammar and spelling.	166	2,93	1,120
I am cautious with materials that may be automatic translations.	165	2,61	1,130

Source: Author

4. DISCUSSION

The Internet is the main source of coursework and project information for students, despite the rise of AI platforms that promise to revolutionize information search. Search engines that provide links to resources instead of direct answers are still widely used, and students often struggle to distinguish between credible and non-credible web sources. This challenge persists despite various educational interventions. Educators have a responsibility to encourage students to critically evaluate materials found on the web and equip them with the skills to assess web information. A good example of this is the University of Berkeley's public web page "Evaluating Resources" (UC Berkeley, 2024).

Higher education students frequently encounter difficulties when evaluating web information, despite using the Internet for academic purposes. Research suggests that while students are skilled at navigating the Internet, they often lack the critical evaluation skills needed to determine the relevance and credibility of online information. However, the assessment of these skills in higher education is still developing, and initial validations indicate a need for further refinement to accurately measure these competencies across disciplines (Molero, et al., 2020). Our research has contributed by validating an assessment tool for this purpose.

Our results reveal an unsatisfactory level of students' skills in evaluating web information. Although the highest score, 2.96, is on the indicator assessing the awareness of the accuracy of the information found, students do not demonstrate the desired level of skills in applying evaluation criteria. A similar study highlights that many college students in higher education lack digital information evaluation skills, including the ability to assess the relevance, accuracy and credibility of online sources (Parsazadeh, Ali, & Saeed, 2015). It is worrying that important indicators such as authorship and expertise of the author, as well as availability of accurately indicated sources of information are neglected. Research indicates that high school students frequently base their evaluations on superficial factors such as a website's URL or popularity rather than on more substantive criteria like expertise and trustworthiness (McGrew, Reynolds, & Glass, 2024). Upper secondary school students find it difficult to evaluate the credibility and argumentative content of online sources, such as blog texts and YouTube videos, on critical topics like child vaccination (Marttunen, Salminen, & Utriainen, 2021). Studies suggest that while higher education students possess some foundational skills for evaluating web information, there is a significant need for targeted

instruction and assessment tools to fully develop these critical competencies (Molerov, et al., 2020), (García, Argelagós, & Privado, 2023), (Hahnel, Eichmann, & Goldhammer, 2020) (Argelagós, Garcia, Privado, & Wopereis, 2022), (Small & Arnone, 1999).

We did not find statistically significant influence of age, gender or year of study on students' skills in evaluating information from internet in the studied sample. Research indicates that age influences students' skills for evaluating web information, with older students typically demonstrating more advanced skills but this relationship is mediated by educational experiences and individual differences (Miller K. , 2016), (Shenton, Pickard, & Johnson, 2014), (Small & Arnone, 1999). Gender can also play a role in how students approach and assess web-based information, though findings are not entirely consistent across studies. Findings imply that while male students may feel more confident in their ability to evaluate web information (Taylor & Dalal, 2017), female students might engage in more thorough evaluative processes (Kofo & Mercy, 2018). Casillas et al. found no significant gender differences in the ability to evaluate web information among students, suggesting that both male and female students possess similar skills when it comes to critical evaluation tasks (Casillas, Cabezas, Ibarra, & Rodríguez, 2017). Owens and Lilly's study supports the idea that while gender may influence the approach to evaluating web information, it is not a definitive factor in skill level. They argue that individual differences, such as prior experience and educational context, are more significant determinants of evaluative ability (Owens & Lilly, 2017).

There is evidence that targeted instructional interventions can improve students' abilities to evaluate online information. For instance, an intervention designed to teach high school students scientific online reasoning (SOR) significantly improved their ability to assess conflicts of interest, relevant scientific expertise, and alignment with scientific consensus (Pimentel, 2024). Despite these improvements, students still need more practice and support to fully develop these skills, indicating that while progress is possible, the current state of students' ability to differentiate between credible and non-credible sources remains inadequate and requires ongoing educational efforts (McGrew, Reynolds, & Glass, 2024), (Marttunen, Salminen, & Utriainen, 2021), (Ziv & Bene, 2022), (Fielding, 2019), (Pimentel, 2024).

5. CONCLUSION

The study has revealed significant shortcomings in digital information evaluation skills, particularly in assessing the authority, accuracy, timeliness, and objectivity of online sources. The skills were assessed using a self-reported questionnaire that was validated for the sample. This suggests that students in higher education may lack the necessary skills to effectively evaluate web resources, which are essential in the digital age for navigating and utilizing information. The current state of higher education students' ability to evaluate web resources indicates a need for ongoing development and implementation of targeted educational interventions.

REFERENCES

- Argelagós, E., Garcia, C., Privado, J., & Wopereis, I. (2022). Fostering information problem solving skills through online task-centred instruction in higher education. *Computers and Education*, 180, 104433. doi:10.1016/j.compedu.2022.104433
- Cárdenas Ruiz, H., Cifuentes Muñoz, Y., Garzón Zea, N., & Rubiano Barriga, C. (2012). *Evaluación de fuentes de información en internet por parte de profesores y estudiantes universitarios : aproximación a sus creencias epistemológicas personales*. doi:10.11144/javeriana.10554.3165
- Casillas, S., Cabezas, M., Ibarra, M. S., & Rodríguez, G. (2017). Evaluation of digital competence from a gender perspective. *TEEM 2017: Proceedings of the 5th International Conference on Technological Ecosystems for Enhancing Multiculturality*, (pp. 1-5). doi:10.1145/3144826.314537
- Chen, Y. (2022). Quality Evaluation of Student Education Management Work Based on Wireless Network Data Mining. *Mathematical Problems in Engineering*, 1, 9182420. doi:10.1155/2022/9182420
- Fielding, J. A. (2019). Rethinking CRAAP: Getting students thinking like fact-checkers in evaluating web sources. *College and Research Libraries News*, 80(11). doi:10.5860/crln.80.11.620
- García, C., Argelagós, E., & Privado, J. (2023). Information skills instruction in Higher Education students using the 4C/ID model. *International Conference on Higher Education Advances (HEAd)* (pp. 137-144). Editorial Universitat Politècnica de València. doi:10.4995/HEAd23.2023.16149
- Hahnel, C., Eichmann, B., & Goldhammer, F. (2020). Evaluation of Online Information in University Students: Development and Scaling of the Screening Instrument EVON. *Frontiers in Psychology*, 11, 562128. doi:10.3389/fpsyg.2020.562128
- Kanmaz, B., & Buduneli, N. (2021). Evaluation of information quality on the internet for periodontal disease patients. *Oral Diseases*, 27(2), 348-356. doi:10.1111/odi.13546

- Kofo, S. A., & Mercy, O. I. (2018). Gender influence on undergraduates' information literacy skills in the use of internet resources for learning in Kwara State, Nigeria. *Malaysian Online Journal of Educational Sciences*, 6(3), 12-19.
- Lapšanský, Š., & Lang, J. (2022). Modeling an author's specific expertise based on educational-related artifacts analysis. *IEEE 16th International Scientific Conference on Informatics (Informatics)* (pp. 208-213). Poprad, Slovakia: IEEE. doi:10.1109/Informatics57926.2022.10083457
- Marttunen, M., Salminen, T., & Utriainen, J. (2021). Student evaluations of the credibility and argumentation of online sources. *The Journal of Educational Research*, 114(3), 294-305. doi:10.1080/00220671.2021.1929052
- McGrew, S., Reynolds, E. C., & Glass, A. C. (2024). The Problem With Perspective: Students' and Teachers' Reasoning About Credibility During Discussions of Online Sources. *Cognition and Instruction*, 42(3), 399-425. doi:10.1080/07370008.2024.2340981
- Miller, C. E., Ward, J. B., Yoganantham, D. C., & Bond, A. (2021). Evaluation of internet derived patient information for Acute Pancreatitis. *Ulster Medical Journal*, 90(1), 7-9.
- Miller, K. (2016). Secondary School Students Ascribe Value to Presentation, Accuracy, and Currency in their Evaluation of Web-Based Information. *Evidence Based Library and Information Practice*, 11(1), 79-81. doi:10.18438/B8NW44
- Mishra, S., Fegley, B. D., Diesner, J., & Torvik, V. I. (2018). Expertise as an aspect of author contributions. *Workshop on Informetric and Scientometric Research SIGMET - Metrics 2018*. Vancouver BC.
- Molero, D., Zlatkin-Troitschanskaia, O., Nagel, M.-T., Brückner, S., Schmidt, S., & Shavelson, R. J. (2020). Assessing University Students' Critical Online Reasoning Ability: A Conceptual and Assessment Framework With Preliminary Evidence. *Frontiers in Education*, 5. doi:10.3389/FEDUC.2020.577843
- Owens, J., & Lilly, F. (2017). The influence of academic discipline, race, and gender on web-use skills among graduate-level students. *Journal of Computing in Higher Education*, 29, 286-308. doi:10.1007/S12528-017-9137-1
- Parsazadeh, N., Ali, R., & Saeed, I. I. (2015). Digital information evaluation skills among students in higher education. *Jurnal Teknologi*, 75(11). doi:10.11113/jt.v75.5336
- Pimentel, D. R. (2024). Learning to evaluate sources of science (mis)information on the internet: Assessing students' scientific online reasoning. *Journal of Research in Science Teaching*, Early view. doi:10.1002/tea.21974
- Shenton, A. K., Pickard, A. J., & Johnson, A. (2014). Information evaluation and the individual's cognitive state: Some insights from a study of British teenaged users. *IFLA Journal*, 40(4). doi:10.1177/0340035214551708
- Small, R. V., & Arnone, M. P. (1999). Evaluating Web Sites: A Critical Information Skill. *IASL Conference Proceedings (Birmingham, Usa): Unleash the Power - Knowledge, Technology, Diversity*. Birmingham. doi:10.29173/iasl8148
- Taylor, A., & Dalal, H. A. (2017). Gender and Information Literacy: Evaluation of Gender Differences in a Student Survey of Information Sources. *College & Research Libraries*, 78(1), 90. doi:10.5860/crl.78.1.90
- Tuzahra, F. (2021). Reading online: Evaluation of online sources credibility. *Journal of Research on Language Education*, 2(1), 32-36. doi:10.33365/JORLE.V2I1.1007
- UC Berkeley. (2024, February 2). *Evaluating Resources: Home*. Retrieved August 11, 2024, from Berkley Library, University of California: <https://guides.lib.berkeley.edu/evaluating-resources>
- Vuong, Q.-H., Le, T.-T., La, V.-P., & Nguyen, M.-H. (2022). The psychological mechanism of internet information processing for post-treatment evaluation. *50 Heliyon*, 8(5), E09351. doi:10.1016/j.heliyon.2022.e09351
- Ziv, N., & Bene, E. (2022). Preparing College Students for a Digital Age: A Survey of Instructional Approaches to Spotting Misinformation. *College and Research Libraries*, 83(6). doi:10.5860/crl.83.6.905
- Zlatkin-Troitschanskaia, O., Hartigb, J., Goldhammer, F., & Krstev, J. (2021). Students' online information use and learning progress in higher education – A critical literature review. *Studies in Higher Education*, 46(10), 1996-2021. doi:10.1080/03075079.2021.1953336