ORIGINAL ARTICLE

## The Relationship between Critical Thinking and Information Literacy in Mashhad University of Medical Sciences Residents in 2020

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**Background**: Information literacy, as a critical skill, is not limited to library-bibliographic skills but it includes analytic-critical thinking skills. The importance of information literacy skills and critical thinking skills in finding information, evaluation, etc. of finned resources is not well known. So this study was designed to determine the critical thinking status and its relationship with information literacy among Mashhad University of Medical Sciences (MUMS) residents.

**Method**: The least sample size determined by the Cochrane formula was 195. Two instruments were used in this study: the thinking skills questionnaire, and the information literacy questionnaire. The questioner went to different wards, explained the study to residents, got the informed consent, took their questionnaires, and finally got back the filled questionnaires. The data was analyse by SPSS ver11.5.

**Results**: 195 clinical residents involved in this study, 66.6% of which were female and 53.3% were married. About 62.05% had a moderate level of information literacy. The best performance regarding the critical thinking domains was analysis and the poorest was evaluation. Information literacy did not have a relationship with general characteristics (p-value>0.05). But being male (p<0.002 , p<0.001)and unmarried (p<0.001 , p<0.001)had positive effects on critical thinking especially in regards to interference and deduction respectively.

**Conclusion**: Residents did not have an acceptable level and were far from the desired level; neither in information literacy nor critical thinking. This study showed a significant correlation between critical thinking and information literacy.

**Keywords**: Information Literacy, Critical Thinking, Specialist Residents

## العلاقة بين التفكير النقدي ومحو الأمية المعلوماتية لدى طلاب جامعة مشهد للعلوم الطبية في عام ٢٠٢٠

**الخلفية:** لا يقتصر محو الأمية المعلوماتية، كمهارة حاسمة، على المهارات المكتبية البيليوغرافية ولكنه يشمل مهارات التفكير التحليلي النقدي. إن أهمية مهارات المعرفة المعلوماتية ومهارات التفكير النقدي في العثور على المعلومات والتقييم وما إلى ذلك من الموارد المالية ليست معروفة جيدًا. لذلك تم تصميم هذه الدراسة لتحديد حالة التفكير النقدي وعلاقتها بالثقافة المعلوماتية بين طلاب جامعة مشهد للعلوم الطبية (MUMS).

**الطريقة:** كان حجم العينة الأقل الذي حددته صيغة كوكرين هو ١٩٥. تم استخدام أداتين في هذه الدراسة: استبيان مهارات التفكير، واستبيان المعرفة المعلوماتية. ذهب السائل إلى أجنحة مختلفة، وشرح الدراسة للمقيمين، وحصل على موافقة مستنيرة، وأخذ استبياناتهم، وأخيراً استعاد الاستبيانات المملوءة. تم تحليل البيانات بواسطة برنامج SPSS ver11.5.

**النتائج:** شارك في هذه الدراسة ١٩٥ مقيمًا سريريًا، ٦٦,٦% منهم إناث و٥٣,٣% متزوجون. حوالي ٦٢,٠٥% لديهم مستوى متوسط من المعرفة المعلوماتية. وكان أفضل أداء في مجالات التفكير الناقد هو التحليل، وأضعفها هو التقييم. لم يكن لمحو الأمية المعلوماتية علاقة بالخصائص العامة (قيمة p > 0.05). لكن كونك ذكراً (p<0.002, p<0.001) وغير متزوج (p<0.001, p<0.001) كان له تأثيرات إيجابية على التفكير النقدي وخاصة فيما يتعلق بالتدخل والاستنباط على التوالي.

**الاستنتاج:** لم يكن مستوى السكان مقبولاً وكانوا بعيدين عن المستوى المطلوب؛ لا في محو الأمية المعلوماتية ولا في التفكير النقدي. أظهرت هذه الدراسة وجود علاقة ذات دلالة إحصائية بين التفكير النقدي ومحو الأمية المعلوماتية.

**الكلمات المفتاحية:** محو الأمية المعلوماتية، التفكير النقدي، المقيمين المتخصصين

## ۲۰۲۰ میں مشہد یونیورسٹی آف میڈیکل سائنسز کے رہائشیوں میں تنقیدی سوچ اور معلوماتی خواندگی کے درمیان تعلق

**پس منظر:** معلوماتی خواندگی، ایک اہم مہارت کے طور پر، لائبریری-بائبلگرافک مہارتوں تک محدود نہیں ہے بلکہ اس میں تجزیاتی-تنقیدی سوچ کی مہارتیں شامل ہیں۔ معلومات کی خواندگی کی مہارتوں اور مالی وسائل کی معلومات تلاش کرنے، تشخیص کرنے وغیرہ میں تنقیدی سوچ کی مہارت کی اہمیت اچھی طرح سے معلوم نہیں ہے۔ لہٰذا یہ مطالعہ مشہد یونیورسٹی آف میڈیکل سائنسز (MUMS) کے رہائشیوں کے درمیان اہم سوچ کی حیثیت اور معلوماتی خواندگی کے ساتھ اس کے تعلق کا تعین کرنے کے لیے ڈیزائن کیا گیا تھا۔

**طریقہ:** Cochrane فارمولے کے ذریعہ کم سے کم نمونہ کا سائز ۱۹۵ مقرر کیا گیا تھا۔ اس مطالعہ میں دو آلات استعمال کیے گئے: سوچنے کی مہارت کا سوالنامہ، اور معلوماتی خواندگی کا سوالنامہ۔ سائل مختلف وارڈوں میں گیا، رہائشیوں کو مطالعہ کی وضاحت کی، باخبر رضامندی حاصل کی، ان کے سوالنامے لیے، اور آخر کار بھرے ہوئے سوالنامے واپس مل گئے۔ ڈیٹا کا تجزیہ SPSS ver11.5 کے ذریعے کیا گیا۔

**نتائج:** اس تحقیق میں ۱۹۵ طبی باشندے شامل تھے، جن میں سے ۶۶٫۶% خواتین اور ۵۳٫۳% شادی شدہ تھیں۔ تقریباً ۶۲٫۰۵% کے پاس معلوماتی خواندگی کی معتدل سطح تھی۔ تنقیدی سوچ کے ڈومینز کے حوالے سے بہترین کارکردگی تجزیہ تھی اور سب سے خراب تشخیص تھی۔ معلومات کی خواندگی کا عمومی خصوصیات (p-value>0.05) سے کوئی تعلق نہیں تھا۔ لیکن مرد ہونا (p <0.002، p <0.001) اور غیر شادی شدہ ( p <0.001، p <0.001) بالترتیب مداخلت اور کٹوتی کے حوالے سے تنقیدی سوچ پر مثبت اثرات مرتب کرتا ہے۔

**نتیجہ:** رہائشیوں کے پاس قابل قبول سطح نہیں تھی اور وہ مطلوبہ سطح سے بہت دور تھے۔ نہ معلومات کی خواندگی میں اور نہ ہی تنقیدی سوچ میں۔ اس مطالعہ نے تنقیدی سوچ اور معلومات کی خواندگی کے درمیان ایک اہم تعلق ظاہر کیا۔

**مطلوبہ الفاظ:** معلوماتی خواندگی، تنقیدی سوچ، ماہر رہائشی

## رابطه تفکر انتقادی و سواد اطلاعاتی در دستیاران دانشگاه علوم پزشکی مشهد در سال ۱۳۹۹

**زمینه و هدف:** سواد اطلاعاتی به عنوان یک مهارت اساسی تنها به مهارت های کتابخانه ای-کتاب شناسی محدود نمی شود، بلکه مهارت های تفکر انتقادی-تحلیلی را نیز شامل می شود. اهمیت مهارت های سواد اطلاعاتی و تفکر نقادانه در پیدا کردن، ارزیابی و غیره اطلاعات در منابع محدود شناخته شده نیست. بنابراین این مطالعه برای شناخت وضعیت تفکر نقادانه و رابطه آن با سواد اطلاعاتی در بین رزیدنت های دانشگاه علوم پزشکی مشهد طراحی شد.

**روش:** کمترین میزان نمونه که با فرمول کوکران مشخص شد ۱۹۵ نفر بود. ما در این مطالعه از دو ابزار پرسشنامه ی مهارت های تفکر و پرسشنامه سواد اطلاعاتی استفاده کردیم. مصاحبه گر پرسشنامه های را به بخش های مختلف بیمارستان برد و بعد از توضیح مطالعه برای رزیدنت ها و اخذ رضایت آگاهانه، پرسشنامه را جهت تکمیل به آنها تحویل داد. و در نهایت پرسشنامه پرشده را از آنها تحویل گرفت. داده ها با نرم افزار SPSS ورژن ۱۱،۵ تحلیل شدند.

**یافته ها:** در این مطالعه ۱۹۵ نفر از رزیدنت های بالینی شرکت کردند که ۶۶،۶٪ آنها خانم و ۵۳،۳٪ متاهل بودند. حدود ۶۲،۰۵٪ سطح سواد اطلاعاتی متوسطی داشتند. بهترین عملکرد در حوزه های تفکر نقاد مربوط به تحلیل و ضعیف ترین عملکرد مربوط به ارزیابی بود. سواد اطلاعاتی با ویژگی های عمومی افراد ارتباطی نداشت (p >0.05). اما از طرف دیگر مرد بودن (p<0.002 , p<0.001)و مجرد بودن((p<0.001 , p<0.001) تأثیر مثبتی برروی تفکر نقادانه مخصوصاً در حیطه های استنباط و استدلال قیاسی داشت .

**نتیجه گیری:** رزیدنت ها سطوح قابل قبولی از دو مهارت سواد اطلاعاتی و تفکر نقادانه نداشتند و از سطوح مطلوب دور بودند. ما ارتباط معناداری بین سواد اطلاعاتی و تفکر نقادانه یافتیم.

**واژه های کلیدی:** سواد اطلاعاتی، تفکر انتقادی، دستیاران تخصصی

## INTRODUCTION

Information literacy, as a skill to access needed information in less time and with low cost, is more valued as a cornerstone in the 21st century (1). Information literacy is defined as a set of skills for accurate identification of information resources, accessing them, and using them purposefully (2). Even though it was defined by the study, research, library, lifelong education, creative thinking, and workplace needed skills and continuous production in the 70th decade (3). Thus students need information literacy skills as a key to lifelong learning (4). Information literacy is defined as a set of skills to correct identification of information resources, accessing to them, and their purposeful use. The basic mission of universities is to create lifelong education for students. Thus students should be educated in a way that can resolve their informative needs according to correct informative behaviours (5). By the essence of work, regarding wide communication with information resources and communication technologies, students need to find out the required subjects of information literacy and this type of education is important for long-term learning (6).

Critical thinking is one of the domains of thinking that has a special place in education (7). It is a cognitive process that enables a person to evaluate and analyze reasons and information to access result, verdict, and decision (8). Critical thinking in education can lead to learning motivation, question-solving skills, decision, and creativity. And also it is one of the components of clinical reasoning, and a criterion for the clinical efficacy of professionals and medical students. It is an important factor in upgrading professional independence and evidence-based medicine (9). World federation for medical education counts critical thinking as one of the standards for medical education. The Five domains of critical thinking includes evaluation, interference, analysis, deduction, and induction (10). It is one of the important skills in clinical reasoning, and improving it can lead to better clinical decisions and thus better care services (11).

The basic role of the higher education system in society's development is confirmed. One of its goals is to train graduates that can do scientific work through different ways of thinking (12). Scientific commission members and professors are aware of the inability of the education system to train critical thinking in students. The inclusion of critical thinking as one of the basic educative components in the educational curriculum is a necessity (13). The gap between theoretical and practical knowledge is perceptible in the medical sciences fields' curriculum. Taheri et al. (14) and Eslami et al. (15) found the weakness of critical thinking in nursing students. They found the role of critical thinking in using theoretical knowledge in practice and eliminating the gap between them (16).

On the other hand, information literacy is one of the basic skills in the information era; the ability to access needed information in the least time and cost is a valuable skill for the people in search of progression (17,18). According to the American library association, a knowledgeable person can recognize information requirement and can locate, evaluate, and effectively use needed information, and finally learns the way to learn. Information literacy is not only limited to the library or bibliographic using of different information resources skills, but also it includes the ability to create new ideas from previous knowledge and analytic-critical thinking skills (19).

It seems that critical thinking and information literacy are aligned and complementary. Because of the importance of information literacy and critical thinking skills in the finding of information and its analysis, evaluation, and interference, this study was designed to determine the critical thinking state and its relationship with information literacy in Mashhad University of Medical Sciences (MUMS) residents.

## METHODS

Selection and Description of Participants: This is a practical cross-sectional study done through the survey method. The statistical population was specialty residents at Mashhad University of Medical Sciences-associated hospitals in 2019. According to the sample size determined by using the Cochran formula and Morgan sample size table, 195 students were selected by stratified random sampling.

Technical information: Data collection was through information literacy and modified California critical thinking skills test (CCTST) questionnaires (latter designed by Fancione) (20), and both were verified by previous studies (21). An information literacy questionnaire was used in previous studies and its narration and reliability were confirmed (22). It evaluated the ability of nature specifying, the extent of information needed, the ability to get needed information, evaluation of the retrieved information, and the use of information effectively for the same purpose, and helped understand economical, legal, and social issues. This questionnaire had 6 questions scoring from 0 to 5 (0=nothing, 1=very low, 2=low, 3=moderate, 4=high, 5=very high). Finally, the mean score in each field was calculated; level of familiarity with reference resources of Persian and English journals, recognition of refereeing methods, acquaintance with databases, amount of research by custom leaflets, familiarity with computer, operating systems, and computer working skills. Based on the type of questions (6-choices Likert scale) average score meant different levels of information literacy; the average score of 1-2: very low, 2-3: low, 3-4: moderate, and 4-5: high.

Statistics: CCTST (form B) had 34 multiple-choice questions with only one correct answer in the five critical thinking cognitive skills domains: interpretation, analysis, evaluation, explanation, and interference. This survey scoring was from 0 to 34. Data were analyzed by the 2 aspects of description and reasoning. For the aspect of description, mean, SD and for inference, and the Pearson correlation test were used. The ethical code was (IR.MUMS.MEDICAL.REC.1398.072) from the ethical committee for this study.

## RESULTS

Overall, from 195 residents who took part in the study, 66.6% of them were female and 53.3% of them were married. The results of this study showed that there was no remarkable

marital difference between males and females (p-value=0.417). Among the participants, 33.36%% had a high level of information literacy, 62.05% were moderate, and the rest of them (3.59%) showed a low level of information literacy.

The average score of the population for critical thinking was 12.05 from 34. The best skills among residents was analysis (score of 4.27 from 9) and the poorest was evaluation by the mean score of 3.45 according to 14 (table 1).

A comparison of information literacy among MUMS residents showed no notable difference between male and female residents (p-value=0.687) and also their marital status (p-value=0.592) (Table 2).

Critical thinking status in this study showed that this can be different by sex (p-value= 0.001), in other words; male residents had a higher level of critical thinking. This difference was more prominent in interference (p-value= 0.002), analysis (p-value= 0.037), and deductive reasoning (p-value= 0.001) (table 3).

Another finding of this study showed that marital state can affect the level of critical thinking (p-value=0.007); unmarried had a better function in critical thinking. Unmarried were better in interference (p-value= 0.001) and deduction (p-value= 0.001) than married.

As reported in table 4, information literacy had a significant relationship with critical thinking and its domains (p-value<0.005).

## DISCUSSION

Results showed that the residents did not have an acceptable level of information literacy and thinking skills; this requires more evaluations and needed actions. Among the critical thinking domains, the best status is for analysis and the poorest for evaluation. Following the results, there was no association between being male or female, unmarried or married, and information literacy. But thinking skills, despite information literacy, had higher level in males and unmarried individuals. Being male was more effective in having better interference, analysis, and deduction. And also being unmarried was more associated with having more interference, and deduction skills.

Also, this study showed that having more information literacy is associated with being more skillful in critical thinking and its dimensions. These results were consistent with those of R. Rezaiee. et al (23) and Moradi R. et al (24) and different from those of Yektakooshali MH. et al (25). Perhaps by this correlation, residents can improve their critical thinking skills by teaching them more information literacy and reverse.

Z Azami, et al. did similar research on 338 students of the School of Management and Medical Information Sciences in 2014. Their tools for assessment were the valid and reliable CCTST and the Information Literacy Standard Questionnaire. According to their results, the critical thinking skills among students were at a low level. They reached a weak correlation between critical thinking and information literacy (P = 0.050). Also, they found that students' information literacy had a positive correlation with inference (r = 0.12, P = 0.040) and analysis parts of critical thinking (r = 16, P = 0.006). Finally, because of the low level of critical thinking in students and the

**Table 1. Critical thinking state of MUMS' residents**

| Domains | No. | Max | Least gotten | Most gotten | Mean±SD | Percentage of the top ceiling |
|---|---|---|---|---|---|---|
| Evaluation | 195 | 14 | 0 | 8 | 3.45±1.41 | 24.64 |
| Interference | 195 | 11 | 2 | 8 | 4.32±1.24 | 39.27 |
| Analysis | 195 | 9 | 0 | 7 | 4.27±1.34 | 47.44 |
| Deduction | 195 | 14 | 1 | 9 | 4.28±1.65 | 30.57 |
| Induction | 195 | 16 | 2 | 9 | 5.48±1.39 | 34.25 |
| Overall | 195 | 34 | 7 | 18 | 12.05±2.19 | 35.44 |

**Table 2. Information literacy state of MUMS' residents according to general characteristics**

| Properties | State | Information literacy | | | p-value |
|---|---|---|---|---|---|
| | | Low | Moderate | High | |
| | | N (Percentage) | N (Percentage) | N (percentage) | |
| Sex | Female | 5 (3.80%) | 83 (63.80%) | 42(32.30%) | 0.687 |
| | Male | 2 (3.10%) | 38 (58.50%) | 25(38.50%) | |
| Marriage state | Unmarried | 3 (3.30%) | 55 (60.40%) | 33(36.30%) | 0.592 |
| | Married | 4 (3.80%) | 66 (63.50%) | 34(32.70%) | |
| Total | | 7 (3.59%) | 121 (62.05%) | 67(33.36%) | |

**Table 3. Gender-based comparison of MUMS' residents' critical thinking state**

| Critical thinking domain | Sex | No. | Mean (SD) | SD error | T | p-value |
|---|---|---|---|---|---|---|
| Evaluation | F | 130 | 3.38 (1.35) | 0.12 | -0.93 | 0.353 |
| | M | 65 | 3.58 (1.53) | 0.19 | | |
| Interference | F | 130 | 4.13 (1.24) | 0.11 | -3.141 | 0.002 |
| | M | 65 | 4.71 (1.14) | 0.14 | | |
| Analysis | F | 130 | 4.13 (1.32) | 0.12 | -2.102 | 0.037 |
| | M | 65 | 4.55 (1.33) | 0.17 | | |
| Deductive reasoning | F | 130 | 3.92 (1.53) | 0.13 | -4.508 | 0.001 |
| | M | 65 | 5.00 (1.66) | 0.21 | | |
| Inductive reasoning | F | 130 | 5.53 (1.38) | 0.12 | 0.69 | 0.491 |
| | M | 65 | 5.38 (1.42) | 0.18 | | |
| Overall | F | 130 | 11.65 (1.95) | 0.17 | -3.729 | 0.001 |
| | M | 65 | 12.85 (2.43) | 0.30 | | |

**Table 4. Critical thinking and information literacy relationship state**

| Domains | Information literacy Pearson correlation | p-value |
|---|---|---|
| Evaluation | 0.188 | 0.009 |
| Interference | 0.290 | 0.001 |
| Analysis | 0.248 | 0.001 |
| Deduction | 0.210 | 0.003 |
| Induction | 0.277 | 0.001 |
| Total | 0.437 | 0.001 |

dependence and relationship between the components of critical thinking and information literacy, they suggested implementing programs to improve students' critical thinking (26).

M Suryaman Putra, et al. designed a descriptive associative study on 96 students of high schools to analyze the effect of reading interest, information literacy, and students critical thinking on students' ability in economic lessons class. The data collection tool was the questionnaire and critical thinking instruments. And the final results could be concluded as the association of critical thinking, reading interest, and information literacy in economic lessons (27).

T Fairuz et al. did a practical study aimed to enhance the critical thinking skills and information literacy of students through developing integrated science teaching materials. They selected students from two classes purposefully with the experimental class using developed teaching materials and the control class using teaching materials commonly used in school. They used a critical thinking skills test and an information literacy test. Based on the results of the data analysis, it concluded the use of developed integrated science teaching materials was effective in enhancing critical thinking skills and information literacy (28).

## LIMITATION

Using two instruments simultaneously and thus having a large number of questions was one of the limitations. Another one was being limited to the Mashhad University of Medical Sciences specialty residents. So this study suggest a wider study with a larger sample size and more diverse fields and levels of graduation.

## CONCLUSION

Clinical residents did not have an acceptable level of information literacy and critical thinking skills. There is a direct relationship between critical thinking fields and information literacy; residents who had a poor function in one had a lower level in another. This could be due to their overlap. Holding critical thinking workshops for residents is suggested.

### Ethical considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors. The ethics committee of Mashhad University of Medical Sciences approved this research, ethics code IR.MUMS.MEDICAL.REC.1398.072.

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