

SYSTEMATIC REVIEW

Digital Literacy among Medical Sciences Students: A Systematic Review and Meta-Analysis



Lida Jarahi¹, Abolfazl Akbari^{2*}, Amir Hossein Kaheni³, Mahdi Amiri², Mahdi Mohammadian Ghosooni²

¹Department of Community Medicine, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

²Student Research Committee, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

³Department of Nutrition Institute for Medical Sciences, Mashhad, Iran

*Student Research Committee, Faculty of Medicine, Azadi Square, Mashhad, 9177899191 Iran

Tel: +989364355095
Email:
Akbaria971@mums.ac.ir

Background: The rapid advancement of digital technology and information has revolutionized teaching approaches, and evidence retrieval in medical academic settings, highlighting the necessity for adequate digital literacy (DL) among students. This research assessed DL and its components within the medical science student population.

Methods: Comprehensive searching was done using the Web of Science, Scopus, Embase, and PubMed databases. Meta-analysis was conducted using CMA V.3.3.

Results: Out of the 6773 identified articles, 54 studies were selected for the final synthesis. DL in medical science students has improved over the past two decades. However, there were differences in the components of DL, with computer literacy ranking the highest and search literacy ranking the lowest. Results of the meta-analysis showed that most students were skilled in using Word Processing (78%) and Presentation (68%) software, while fewer were skilled in using Spreadsheets (49%) and Email (34%).

Conclusion: Medical science students have made progress in DL but there is still a gap in achieving expected competency. The COVID-19 pandemic has pushed the adoption of digital technologies for online learning, benefiting DL. This experience should guide educational practices, emphasizing online and blended learning, and integrating ICT courses into the medical science curriculum.

Keywords: Digital Literacy, Online education, Medical Sciences Students, Information and Communications Technology

محو الأمية الرقمية بين طلاب العلوم الطبية: مراجعة منهجية وتحليل تلوي

الخلفية: أحدث التقدم السريع في التكنولوجيا الرقمية والمعلومات ثورة في أساليب التدريس واسترجاع الأدلة في الأوساط الأكاديمية الطبية، مما سلط الضوء على ضرورة المعرفة الرقمية الكافية (DL) بين الطلاب. قام هذا البحث بتقييم DL ومكوناته ضمن مجتمع طلاب العلوم الطبية.

الطرق: تم إجراء البحث الشامل باستخدام قواعد بيانات Web of Science و Embase و Scopus و PubMed. تم إجراء التحليل التلوي باستخدام CMA V.3.3.

النتائج: من أصل 6773 مقالة تم تحديدها، تم اختيار 54 دراسة للتوليف النهائي. لقد تحسنت DL لدى طلاب العلوم الطبية خلال العقدين الماضيين. ومع ذلك، كانت هناك اختلافات في مكونات DL، حيث احتلت معرفة القراءة والكتابة الحاسوبية المرتبة الأعلى ومحو الأمية البحثية في المرتبة الأدنى. أظهرت نتائج التحليل التلوي أن معظم الطلاب كانوا ماهرين في استخدام برامج معالجة النصوص (78%) والعروض التقديمية (68%)، بينما كان عدد أقل من الطلاب ماهرين في استخدام جداول البيانات (49%) والبريد الإلكتروني (34%).

الاستنتاج: حقق طلاب العلوم الطبية تقدماً في التعلم عن بعد ولكن لا تزال هناك فجوة في تحقيق الكفاءة المتوقعة. لقد دفعت جائحة كوفيد-19 إلى اعتماد التقنيات الرقمية للتعلم عبر الإنترنت، مما أفاد التعلم عن بعد. وينبغي لهذه التجربة أن توجه الممارسات التعليمية، مع التركيز على التعلم عبر الإنترنت والمختلط، ودمج دورات تكنولوجيا المعلومات والاتصالات في مناهج العلوم الطبية.

الكلمات المفتاحية: محو الأمية الرقمية، التعليم عبر الإنترنت، طلاب العلوم الطبية، تكنولوجيا المعلومات والاتصالات

سواد دیجیتال در بین دانشجویان علوم پزشکی: مروری سیستماتیک و متآنالیز

زمینه و هدف: پیشرفت سریع فناوری و اطلاعات دیجیتال، تحولی را در رویکردهای آموزشی و بازیابی شواهد در محیط‌های دانشگاهی ایجاد کرده که ضرورت سواد دیجیتال مناسب را در دانشجویان اجتناب ناپذیر نموده است. این تحقیق به بررسی سواد دیجیتال و مولفه‌های آن در دانشجویان علوم پزشکی پرداخته است.

روش: جستجو در پایگاه‌های Web of Science، Embase، Scopus، و PubMed جهت بررسی سواد دیجیتال و مولفه‌های آن در دانشجویان علوم پزشکی صورت گرفت. تحلیل داده‌ها با استفاده از نرم افزار CMA V.3.3 انجام شد.

یافته‌ها: از 6773 مقاله شناسایی شده، 54 مطالعه برای تحلیل نهایی انتخاب شدند. سواد دیجیتال در دانشجویان علوم پزشکی طی دو دهه گذشته افزایش داشت اما تفاوت‌هایی در مولفه‌های آن مشاهده شد، به طوری که سواد رایانه بالاترین و سواد جستجو کمترین رتبه را داشت. نتایج متآنالیز نشان داد که اکثر دانشجویان علوم پزشکی مهارت کافی در استفاده از نرم‌افزارهای واژه‌پردازی (78٪) و ارائه (68٪) داشتند اما فراوانی دانشجویان ماهر در استفاده از صفحات گسترده (49٪) و ایمیل (34٪) مناسب نبود.

نتیجه‌گیری: گرچه دانشجویان علوم پزشکی پیشرفت قابل توجهی در سواد دیجیتال داشته‌اند، تا شایستگی مورد انتظار آنها فاصله وجود دارد. همه گیری COVID-19 با تسریع پذیرش فناوری‌های دیجیتال برای یادگیری آنلاین، تأثیر مثبتی بر سواد دیجیتال دانشجویان داشت که این تجربه باید برای شیوه‌های آموزشی آنلاین و ترکیبی و تمرکز بر ادغام دوره‌های فناوری اطلاعات و ارتباطات در برنامه درسی علوم پزشکی استفاده شود.

واژه‌های کلیدی: سواد دیجیتال، آموزش آنلاین، دانشجویان علوم پزشکی، فناوری اطلاعات و ارتباطات

میڈیکل سائنسز کے طلباء میں ڈیجیٹل خواندگی: ایک منظم جائزہ اور میٹا تجزیہ

پس منظر: ڈیجیٹل ٹیکنالوجی اور معلومات کی تیز رفتار ترقی نے تدریسی طریقوں میں انقلاب برپا کر دیا ہے، اور میڈیکل اکیڈمک سیٹنگز میں شواہد کی بازیافت، طلباء میں مناسب ڈیجیٹل خواندگی (DL) کی ضرورت کو اجاگر کرتی ہے۔ اس تحقیق نے میڈیکل سائنس کے طلباء کی آبادی کے اندر DL اور اس کے اجزاء کا جائزہ لیا۔

طریقے: ویب آف سائنس، اسکوپس، ایمیس، اور ایپ میڈ ڈیٹا بیس کا استعمال کرتے ہوئے جامع تلاش کی گئی۔ میٹا تجزیہ CMA V.3.3 کا استعمال کرتے ہوئے کیا گیا تھا۔

نتائج: 6773 شناخت شدہ مضامین میں سے، 54 مطالعات کو حتمی ترکیب کے لیے منتخب کیا گیا۔ گزشتہ دو دہائیوں میں میڈیکل سائنس کے طلباء میں ڈی ایل میں بہتری آئی ہے۔ تاہم، DL کے اجزاء میں اختلافات تھے، کمپیوٹر کی خواندگی کی درجہ بندی سب سے زیادہ اور تلاش خواندگی کی درجہ بندی سب سے کم تھی۔ میٹا تجزیہ کے نتائج سے پتہ چلتا ہے کہ زیادہ تر طلباء ورڈ پروسیسنگ (78٪) اور پریزنٹیشن (68٪) سافٹ ویئر استعمال کرنے میں مہارت رکھتے تھے، جبکہ بہت کم اسپریڈ شیٹس (49٪) اور ای میل (34٪) استعمال کرنے میں ماہر تھے۔

نتیجہ: میڈیکل سائنس کے طلباء نے DL میں ترقی کی ہے لیکن متوقع قابلیت کے حصول میں ابھی بھی خلا باقی ہے۔ COVID-19 وبائی مرض نے آن لائن سیکھنے کے لیے ڈیجیٹل ٹیکنالوجیز کو اپنانے پر زور دیا ہے، جس سے DL کو فائدہ پہنچا ہے۔ اس تجربے کو تعلیمی طریقوں کی رہنمائی کرنی چاہیے، آن لائن اور ملاوٹ شدہ سیکھنے پر زور دینا، اور ICT کورسز کو میڈیکل سائنس کے نصاب میں ضم کرنا چاہیے۔

کلیدی الفاظ: ڈیجیٹل خواندگی، آن لائن تعلیم، میڈیکل سائنسز کے طلباء، انفارمیشن اور کمیونیکیشن ٹیکنالوجی

INTRODUCTION

The evolution of digital technology has brought about significant changes in teaching methods, collaborative networks, research management, and the search for relevant evidence in the medical academic field(1). This transformation underscores the growing necessity for students to possess digital literacy (DL), defined as the proficient use of Information and Communications Technology (ICT) tools and computers to create and exchange information within e-networks (1-4).

DL encompasses the acquisition of knowledge and skills essential for adeptly utilizing technology, digital tools, e-communications, e-learning platforms, and conducting database searches (1,2). It encompasses various literacies such as information literacy, computer literacy, Internet literacy, network literacy, and media literacy, signifying the diverse skill sets associated with DL.(5).

The three core domains of DL include the technical or operational domain (mastery of ICT), the cognitive domain (critical evaluation, information management, selection of appropriate software programs, and understanding the legal aspects of using digital resources), and the ethical or social

domain (responsible and ethical behavior in an online environment, especially to privacy and protection of information (6,7).

A significant proportion of physicians and healthcare professionals lack the necessary digital literacy skills to effectively utilize advanced technology for professional purposes (8,9). Studies have shown that a high percentage of medical science students struggle with retrieving evidence-based information, conducting effective searches, and processing and utilizing the obtained information (9). Although medical student curricula often include the teaching of evidence-based medicine (EBM), it is crucial to include the learning of DL skills as a prerequisite for the effective use of EBM in a professional setting (8-10).

This study aims to comprehensively assess medical students' digital literacy level and explore its requirements.

METHODS

The study aimed to evaluate the digital literacy of undergraduate medical sciences students. It followed guidelines from the Joanna Briggs Institute and reported findings using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement (Figure 1).

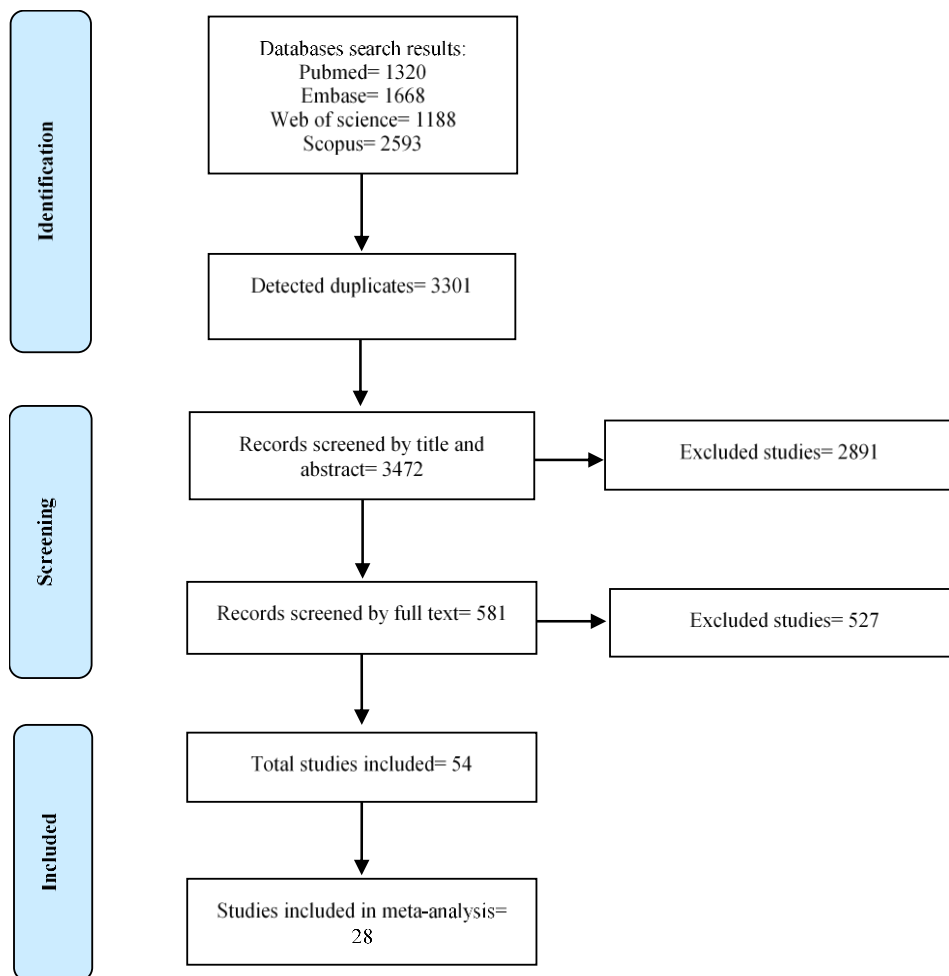


Figure 1. PRISMA flow chart of literature inclusion

Search strategy and selection criteria

A systematic search was conducted across major bibliographic databases including ISI Web of Science, Scopus, Embase, and PubMed using specific keywords related to "Literacy", "Digital", "Student", and "Medicine". The search had no language or time restrictions, covering databases up to 2021. Following this, reference lists of eligible studies were hand-searched.

The researchers used the search terms Literac* or Skill or Knowledge or Information or Education, Student or Educate or Learner or train or Undergrad or Studding, Medic* or Premedic* or Nurs* or Dent* or Pharm* or Health, Digit* or Techno* or Computer* or Internet* or Online*. Two researchers (A.A. and A.K.) independently performed all searches and any conflict between them was checked out by an examiner (L.J.).

The retrieved articles were exported to EndNote (version X.8) and underwent deduplication. Two separate teams of reviewers (M.A., M.M.G., and A.A., A.K.) evaluated titles and abstracts for eligibility, with any discrepancies resolved by an examiner (L.J.). Original studies meeting the criteria of investigating DL or its equivalents in undergraduate medical sciences students and published in peer-reviewed journals were considered. The Medical Education Research Study Quality Instrument (MERSQI) was employed to assess the quality of the study, evaluating study design, sampling, instrument, and data analysis.

Data extraction

Title and abstract screening was performed initially, with full texts of eligible papers reviewed by two separate reviewer

teams. Any discrepancies were resolved by a supervised reviewer. Data extraction was carried out by two independent research teams using a predetermined form. Extracted data included study title, author, design, country, year, sample size, students' field of study, and various aspects of digital DL assessed such as digital tools, office software skills, internet usage, and communication applications.

Data analysis

A Meta- analysis was conducted using a random- effects model by Comprehensive Meta- analysis (CMA) software version 3.3. Heterogeneity was evaluated through I2 values, showing 23% which suggests low heterogeneity. Additionally, the meta-analysis was carried out across the main categories of DL.

RESULTS

In this study, out of the 6773 articles initially identified, duplicates were removed, and 3472 studies were screened based on title and abstract for eligibility. Following this, the full text of 581 eligible papers was reviewed, leading to the inclusion of 54 relevant studies in the review and 28 studies in the meta-analysis process (Table 1). The results were categorized into four main categories: literacy of Computer/Digital/Internet/information technology (IT)/ICT, search literacy, tasks through digital devices, and computer/smartphone/tablet use. Figures 2-5 show the results of the Meta-analysis for estimation of the rate of skilled medical sciences students in using Word Processing, Presentation, Spreadsheet Applications, and Software, and the rate of E-mail use on a daily to weekly basis.

Table 1. Characteristics of included studies in meta-analysis

Author	Year	Country/ university	Subject	Sample Size	Rate of response	Findings
Hollander.	1996-1997	US/University of Illinois at Rockford	Medical	86	54%	- 81%, 66%, 20%, 34% and 40% reported excellent/good skill of word processing, E-mail, presentation software, telecommunications software and searching journal literature, respectively. - 11%, 16%, 21%, 29% and 40% reported fair skill of word processing, E-mail, presentation software, telecommunications software and searching journal literature, respectively.
Grigg et al.	1997-1998	UK/University of Bristol	Dental	42	86%	-33.4% and 35.7% reported are competent in most/expert in general IT skills and word processing, respectively. -52.4% and 54.8% reported are competent in basic general IT skills and word processing, respectively.
Grigg et al.	1997-1998	UK/Manchester	Dental	54	82%	-27.8% and 44.4% reported are competent in most/expert in general IT skills and word processing, respectively. -35.2% and 37.5% reported are competent in basic skills in general IT skills and word processing, respectively.
Grigg et al.	1997-1998	UK/Newcastle	Dental	49	74%	-28.3% and 37% reported are competent in most/expert in general IT skills and word processing, respectively. -45.7% and 32.6% reported are competent in basic skills in general IT skills and word processing, respectively.
Virtanen et al.	2000	Finland/University of Oulu	Dental	133	95%	-96.2% could employ word-processing software. -57.3% are familiar with the PowerPoint software. -38.5% can apply PubMed database. -78.9% can apply Ovid Medline database. -60% use E-mail every day.

Table 1. Continued						
Author	Year	Country/ university	Subject	Sample Size	Rate of response	Findings
Rajab et al.	2002-2003	Jordan/University of Jordan	Dental	268	81%	-70.5% and 80.6% are competent in some/most basic general IT skills and word processing. -9% and 2.2% use PubMed and dental journals, respectively. -15.7% use email every day.
Samuel et al.	2003	Tanzania /Muhimbili University	Medical	92	72%	-Generic and specific ICT scores were 11.1 (of 33) and 7.7 (of 16), respectively. -19%, 76%, 34%, 25% and 58% had advanced/average skills in presentation software (PowerPoint), E-mail, word processing, spreadsheets and internet, respectively.
Lim et al.	2001-2004	Malaysia/Putra University	Medical	289	91.7%	-95.9%, 96.6, 97% and 60.2% had ability to perform word processing, E-mailing, surfing web and graphics.
Maharana et al.)	2009 published	India/VSS Medical College, Burla	Medical	128	85.3%	-8.6% use E-mail every day. -41.4%, 39.6 and 58.5 are confident/very confident in word processing, spreadsheet and internet.
Achampong et al.	2010 published	Ghana/University of Cape Coast	Medical	35	92%	-93.5% are confident/very confident in use and knowledge about computers.
Deltsidou et al.	2010 published	Greece/Central Greece	Nursing	310	95%	-67% were skilled in word processing. - 12.6% have very good knowledge on computer use, but, 4.6 % have no knowledge at all.
Fadeyi et al.	2009	Nigeria /University of Ilorin	Medical	479	95.8%	-90.4%, 73.1%, 50.5% and 44.9% had skill in internet, Word Processing, Presentation software and Spreadsheet, respectively. -45.7% had intermediate/advanced computer skill.
Houshyari et al.	2012 published	Iran/Iran University	Medical	445	61%	-Word software (72.2% scored themselves 16–20 of maximum 20) and PowerPoint (55.1% scored themselves 16–20 of maximum 20) -Overall self-perceived computer skills/knowledge was 14.9 (of 20)
Masic et al.	2012-2013	Bosnia and Herzegovina/University of Sarajevo	Medical	197	-	-95%, 92%, 60%, 76% and 95% know almost/excellently MS word, MS PowerPoint, MS Excel, basic informatics and internet.
Masic et al.	2015-2016	Bosnia and Herzegovina/University of Sarajevo	Medical	262	-	-98%, 95%, 68%, 88% and 95% know almost/excellently MS word, MS PowerPoint, MS Excel, basic informatics and internet.
Robabi et al.	2014 published	Iran/ University of Zahedan	Medical Dental Nursing Midwifery Health Paramedics	385	-	-29.4% use Email every day. -62.8%, 70.9% and 17.9% are good/very good in Word Processing, Presentation Software and Spreadsheets respectively.
Mohebbi et al.	2015	Iran/ Tehran University	Dental	218	87%	-31% use Email every day. -76%, 73%, 81%, 32% and 16% are skilled/very skilled in Word Processing, advanced web search, PowerPoint, Excel and Statistical software. -69% and 27% are good/perfect in searching Medline (PubMed) and Cochrane, respectively.
Bayomy et al.	2014-2015	Egypt/Benha University	Medical	141	34.4%	-71.2% and 97.2% are familiar with basic Word Processing and Internet/web searching.
Gonen et al.	2016 published	Israel	Nursing	59	-	-97%, 98%, 77%, 93% and 93% have more than little knowledge about Word Processing, surfing the web, Excel, PowerPoint and E-mail, respectively.
Awotona et al.	2016	Nigeria/Oyo State	Midwifery	37	-	-62%, 29.7%, 45.9%, 40.5%, 47% and 56.8% are Confident/very confident in using E-mail, PowerPoint, Word Processing, Spreadsheets, Medline and internet. -51.4% lack of search skills.
Prabhavathi et al.	2014-2017	India/SRM Medical College	Medical	309	-	-Word Processing skilled 41%, email using 97%, and Internet surfing 85%.

Table 1. Continued

Author	Year	Country/ university	Subject	Sample Size	Rate of response	Findings
Višnjić et al.	2015-2016	Serbia/Niš	Medical Dental Pharmacy	292	86%	-69.5%, 53.4%, 72.6%, 90.4%, and 51.7% were good/very good/excellent in Microsoft Office Word, Microsoft Office Excel, Microsoft Office Power Point, Internet and Basics of computer use.
Visnjic et al.	2015-2016	Serbia/Niš	Medical Dental Pharmacy	292	86%	-75.2%, 46.6%, 83.2%, 80.5%, and 82.8% had Average/Very good knowledge in Microsoft Office Word, Microsoft Office Excel, Microsoft Office Power Point, Internet and Basics of computer use.
Honey.	2015	New Zealand	Nursing	226	74.8%	-98.7%, 86.5% and 46.9% were to some extent familiar/familiar/very familiar with Word Processing, Spreadsheets and reference management. - The most commonly used search engine was Google scholar (91%) and subject specific academic databases (e.g. PubMed) (78%). -65% use E-mail every day.
Woreta et al.	2011	Ethiopia/University of Gondar	Medical sciences	1096	97.8%	-51% had ICT knowledge. -57% competent in some/most basic IT skill. -14% competent in some/most word processing skill.
Dery et al.	2014	Ghana/University of Ghana	health Dental Medical Nursing Pharmacy Public health	773	95%	- 45.7% use E-mail every day. - 79.1% rated themselves as good/very good in computer skills.
Akman et al.	2014 published	Turkey/ five universities in Ankara	Nurse	238	-	-36.6% use E-mail every day.
Uribe et al.	2004	Chile/University of Valparaiso	Dental	162	65%	-54.3% use E-mail every day.
Ray et al.	1997-1998	Ireland	Dental	140	77.8	-10% use E-mail every day.
Link et al.	2004-2005	Austria/University of Vienna	Medical	1160	79%	-44.4% use E-mail every day.
Wong et al.	2012-2013	Malaysia/ University in Kuala Lumpur	Medical	701	67.5%	- 76.8%, 55.3, 50.9%, 41.9% and 21.2% are overall awareness of PubMed/medicine, Ovid databases, science direct, Cochrane library and Web of science.

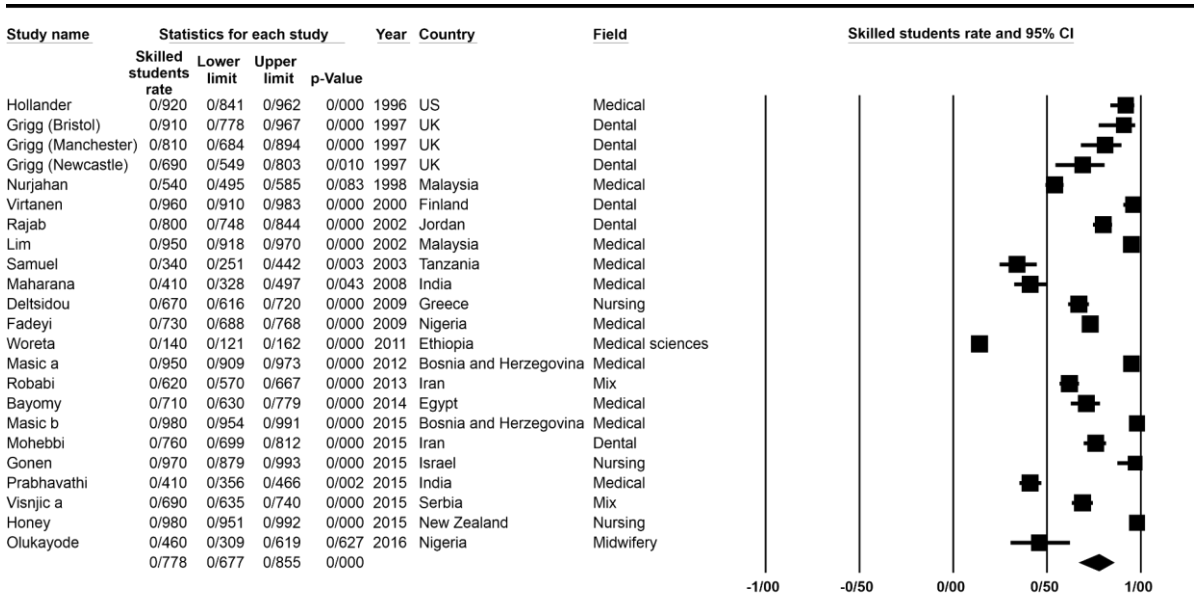


Figure 2. Result of meta-analysis for estimation of the rate of skilled medical sciences students in using Word Processing

1. Literacy in Computer/Digital/Internet/IT/ ICT

Twenty-five articles were analyzed on the topic of computer literacy, DL, internet literacy, ICT, or IT literacy.

Two studies conducted among medical science students in the United Kingdom in 1991 and 1998 at Glasgow and Bristol universities revealed that a significant portion of students (25%) had not used a computer, with a notable percentage considering themselves beginners in computer usage (16%), 52% of students were proficient in basic general IT skills, while 33% demonstrated advanced IT skills (11,12). Subsequent assessments after 2000 in different countries showed a higher proportion of students possessing basic IT skills. Studies in Jordan, Ethiopia, Tanzanian, and Malaysia, reported differing levels of ICT understanding and awareness among health science and medical students (70% in 2003, 51% in 2011, 30% in 2013, and 50% in 2013 respectively)(10,13-15).

Various studies conducted at universities worldwide have shed light on the level of ICT knowledge among students in different academic fields. Findings from the University of Otago in New Zealand, Bosnia and Herzegovina universities, the University of Lagos in Nigeria, the University of Ghana, and Jundishapur University in Iran have indicated variations in ICT literacy among medical and health sciences students over the past two decades from 80% to 87% (16-21)

While some students exhibit a high proficiency in basic IT skills, others still struggle with inadequate knowledge in this area. The results reflect the impact of a country's development level and the specific field of study on students' digital literacy (11-13, 17, 19, 22-36).

2. Search literacy

Studies have examined different aspects of search literacy: experience with database searches, search skills, frequency of searching, familiarity with different journals, and the main reasons for seeking information.

Earlier studies focused on assessing the knowledge of medical science students regarding medical databases. However, recent studies have delved into specific databases and search engines, such as PubMed, Scopus, Cochrane

Library, Web of Science, and Google Scholar (34-39).

Less than 50% of medical science students were familiar with effective search techniques in medical databases or lacked sufficient familiarity with specific medical databases, but recent studies show an improvement with more than half meeting adequate search literacy criteria (19, 40-44). Despite this, students still heavily rely on Google for searches, PubMed/Medline is the preferred choice for academic searches, followed by other databases (3, 29-31, 39-42). Medical science students often struggle with advanced search techniques and face challenges with locating databases and using Boolean operators (3, 41-45).

3. Tasks through digital devices

Using of digital tools for different tasks were compiled for software and applications related to word processing (such as Microsoft Word, Google Docs, Grammarly, LibreOffice, etc.), presentation software (including Microsoft PowerPoint, Prezi, Google Slides, Ludus, etc.), spreadsheet programs (like Microsoft Excel, Google Sheets, Smartsheet, LibreOffice Calc, etc.), and the frequency of email usage (10, 12-14, 17, 20, 25,31, 35,36, 39, 41, 43, 44, 46-58).

The meta-analysis revealed that proficiency levels varied across different tools, with students demonstrating 78% proficiency in word processing (CI95%=67-85), 68% in presentation software(CI95%=0.54-0.79), and 49% in spreadsheet applications(CI95%=36-62). The frequency of email usage among students was found to be 34% (CI95%=25-42).

Survey data from 1996 to 2021 indicated a steady improvement in students' word processing skills, Pre-2000 studies showed 70% of students were familiar with software like MS Office Word and WordPerfect. From 2000 to 2010, students' Word Processing skills increased from 70% to 86%, remaining stable at 73% post-2010.

Among 21 studies, 6 focused on dental students, 9 on medical students, and 4 on students from other fields, with no significant differences in proficiency observed (10, 12, 13, 19, 25, 31, 36, 39, 41, 44, 46-49, 51-54).

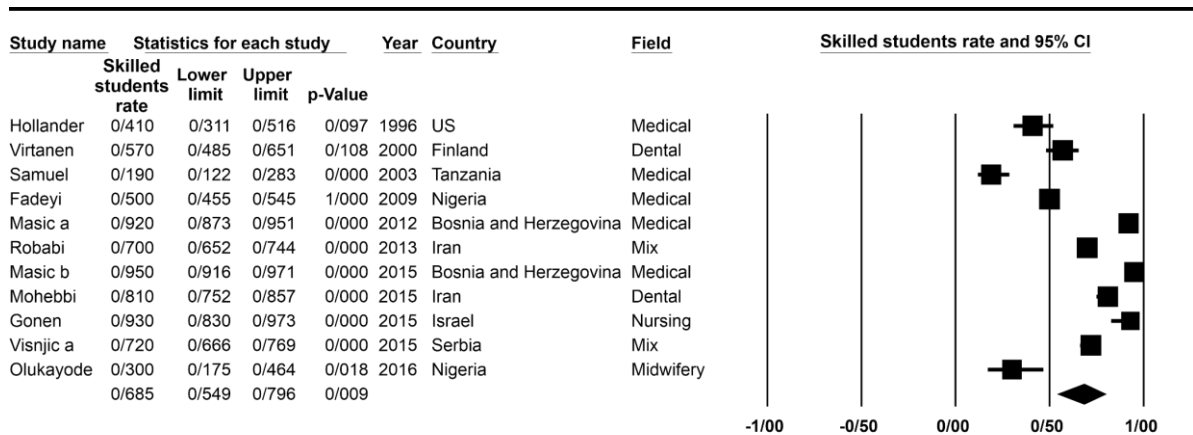


Figure 3. Result of meta-analysis for estimation of the rate of skilled medical sciences students in using Presentation Software.

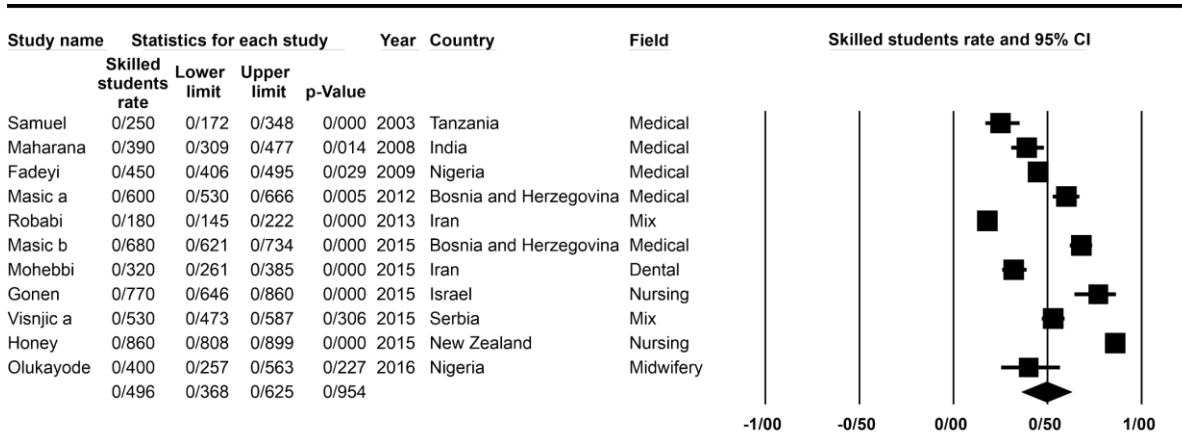


Figure 4. Result of meta-analysis for estimation of the rate of skilled medical sciences students in using Spreadsheets Software

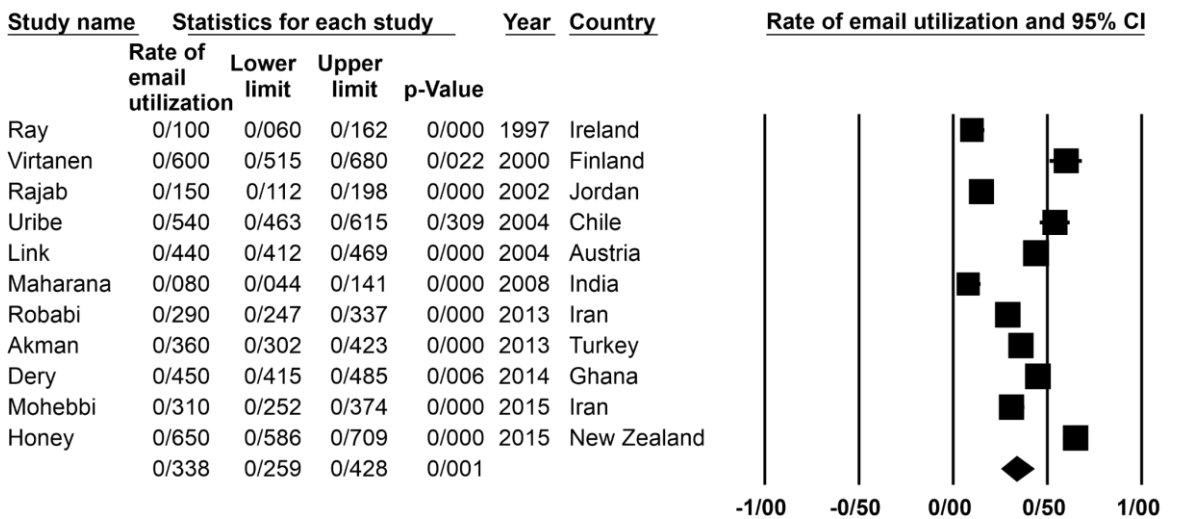


Figure 5. Result of meta-analysis for estimation of the using rate of Email in the medical sciences students.

The proficiency in Presentation Software among medical sciences students increased from 43% pre-2000 to 70% by 2021, while Spreadsheet Application proficiency rose from 27% to 70% between 2000 and 2010 before dropping to 0.52% in 2021. Email usage peaked at 84% in 2010 before declining slightly to 72% by 2021.

4. Computer/Smartphone/Tablet Usage

Students typically own digital devices in the following order: basic phone, laptop/computer, smartphone, and tablet. Over the last twenty years, nearly all students have had access to a computer, either through personal ownership or college resources. Before 2010, smartphone ownership was significantly lower compared to after that year (16% before, 27% after, 55-59% currently), with variations based on the country's income level. It appears that computer ownership used to be higher than smartphone ownership, but now they

are nearly equal, especially as smartphone ownership continues to rise (16, 27, 50, 55-61).

DISCUSSION

This research explored DL levels among medical sciences students, revealing Word Processing, Presentation, and Spreadsheet tools as commonly used software. While DL levels were found to be insufficient, there has been an upward trend in recent years, influenced by varying levels of development and income across countries. Notable gaps existed in participants' familiarity with digital tools, with many lacking advanced search skills in medical sciences databases. Given the importance of DL in medical education and research, there is a growing need for educational initiatives to enhance students' digital skills in the field (32,52, 61,62). Effective search abilities are important for medical research and EBM and medical students are

expected to have more advanced computer skills beyond basic familiarity (61,62).

The use of MS Office software in academic settings remains prevalent, though proficiency in Spreadsheet tools lags, suggesting room for improvement. Email usage in academia and globally surged in the late 20th century but has declined in the past decade with the emergence of social networking platforms. Research indicates that pharmacy and medical students demonstrate higher DL skills than nursing and dental students (11, 21).

There have been reports of enhancements in students' DL following intervention programs in different studies (47, 50). Numerous studies have highlighted the necessity and interest of medical sciences students in incorporating a fundamental computer literacy course, computer skills training, and internet usage into their educational curriculum (32, 52, 59, 63).

The COVID-19 pandemic in 2020 accelerated the transition to online education, highlighting the importance of digital literacy for students (1,64-67). Challenges in online learning include difficulty with technology, lack of experience, and limited access to resources, particularly affecting lower-income students (64-67). Medical sciences students with limited DL have reported struggling more with online learning which emphasizes the necessity for improved digital literacy among students to effectively engage in distance education (66-67).

LIMITATION

The study did not explore variations in digital literacy among medical sciences students across different countries, emphasizing that digital literacy encompasses cognitive and socio-emotional dimensions beyond technical skills. While surveys often concentrate on technical aspects like software usage and online safety, there is a call for more research on cognitive facets such as critical thinking and evaluating digital content.

CONCLUSION

Medical sciences students need to possess DL to enhance their competency for education and future healthcare practice. Recent studies have indicated a growth in DL among students; however, there remains a gap between the desired competency level and the current situation.

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.

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