

Digital Health Literacy (DHL) Levels Among Nursing Baccalaureate Students And Their Perception And Attitudes Toward The Application Of Artificial Intelligence (AI) In Nursing

Shaimaa Hassan Mekawy⁽¹⁾, Shaimaa Ali Mohamed Ismail⁽²⁾, Maaly Zayed Mohamed⁽³⁾

(1) Lecturer, Nursing Administration Department, Faculty of Nursing, Cairo University, Egypt

(2) Lecturer, Nursing Administration Department, Faculty of Nursing, Cairo University, Egypt

(3) Lecturer, Nursing Administration Department, Faculty of Nursing, Cairo University, Egypt

Abstract

Background: Artificial intelligence (AI) technology and digitalization in healthcare have advanced quickly in recent years, altering all sides of daily life and playing an expanding role in nursing education and healthcare. In order to succeed academically and utilize technology in nursing education and practice in the future, nursing students must have adequate digital health literacy. **Aim of the study:** This study aimed to measure the digital health-literacy levels among baccalaureate nursing students and its relation to their perception and attitudes towards the application of AI. **Design:** A descriptive correlational design was utilized to fulfill the aim of this study. **Setting:** The current study was conducted in the Faculty of Nursing, Cairo University. **Sample:** A convenient sample of (128) Baccalaureate nursing students who registered for the 4th academic level - 1st semester of 2019/2020 academic year. **Tools:** Two tools were used as follows; I. Nursing students' perspectives on artificial intelligence questionnaire and II. Self-administered Digital Health Literacy scale. **Result:** The majority of baccalaureate nursing students have a moderate to a high level of digital health literacy. Also, there was a higher perception among baccalaureate nursing students regarding the application of AI in nursing. Moreover, their attitudes and feeling toward AI were moderate. **Conclusion:** The study finding revealed that there was no statistically significant correlation between the total score of AI in nursing and the total score of digital health literacy among baccalaureate nursing students. **Recommendations:** Develop an innovative undergraduate curriculum that includes opportunities for students to experience digital healthcare technologies such as AI to improve their digital competency and assist learners in its entry-level nursing programs access to the necessary digital tools.

Keywords: Artificial Intelligence Digital Health Literacy, Digitalization, Perception, Technology, and Nursing Students.

Introduction:

Digital healthcare has emerged as the result of digital transformation, which offers unique opportunities to strengthen health systems and meet different challenges responding to change health needs, such as the current epidemics of infectious and chronic diseases across the world (Nes, et al., 2020). WHO developed a framework that includes a wide range of digital tools and interventions, such as computers and smart mobile phones to intangible products such as software, web-based platforms, telemonitoring, and algorithms, e.g., artificial intelligence (AI). Despite its potential effectiveness, digitalization is not fully implemented in clinical practice (WHO, 2018; and Elsayed & Sleem, 2020).

The concept of digital health literacy (DHL) is created from health literacy in the context of

information technology. However, these two concepts have the same operational definition; various definitions of health literacy described as digital health (E-health) literacy, all essential skills needed to locate, understand, use, and evaluate electronic, web-based, and mobile resources to make informed choices regarding health promotion and disease prevention and management (Griebel et al., 2017; and Holt, Overgaard, & Engel, 2020). Hence, digital health literacy appears as a new concept, which can be implicit as "an extension of health literacy within the context of technology or electronic sources of information to understand and address any health problem" (Zakar, Zakar, & Fischer, 2020). Although technology has the potential to improve access to information and enhance the interaction between the patient and healthcare giver and lead to enhanced DHL (Harerimana & Mtshali, 2020).

High levels of digital health literacy are associated with better health outcomes for patients, nurses, and medical professionals as well as the general public (Cho, Han, & Park, 2018). However, if patients are unable to use technology, they will not be able to search for, find, validate, and share information while maintaining their privacy (Harerimana & Mtshali, 2020). DHL is viewed as necessary for a patient-based healthcare system to go digital (UNESCO, 2018).

Artificial intelligence (AI) is a crucial technology that will play a primary role in the fourth industrial revolution. To date, many experts have discussed the role and scope of AI in dramatically increasing diagnostic efficiency in medical practice, making accurate decisions, and addressing the issue of medical staffing shortages (Rajkomar, Dean & Kohane, 2019; and Topol, 2019).

The use of AI in nursing has already taken place in the analysis of electronic nursing records, clinical decision support through analysis of pressure sores and safety risks, nursing robots, and scheduling (Topol, 2019; and Ronquillo et al, 2020). However, despite positive performance and utilization expectations from the application of AI technology in the healthcare setting, there are growing alarms. These alarms relate to various unpredictable problems, discrimination, and ethical issues caused by malfunctions and incomplete technology of AI medical devices, alteration and bias of information due to lack of accumulated data or learning errors in AI, and invasion of privacy is also growing (Fenech, Strukelj & Buston, 2018; and Kim & Shin, 2020).

In addition, the use of technology predominantly depends on the user's attitude and so embracing and use of new technology is always influenced by one's attitude toward that technology. Furthermore, it has been demonstrated that little AI exposure makes undergraduate nursing students anxious and influences their decision-making about their future careers (Elsayed & Sleem, 2020).

Artificial intelligence has the potential to enhance the delivery of nursing care by automating routine and time-consuming tasks that do not require specialized nursing knowledge or skills (such as managing hospital room logistics, calling housekeeping for cleaning, and restocking

room supplies), freeing up time for nurses to concentrate on direct (rather than indirect) patient care. Conversely, using AI simultaneously increases the risk of unforeseen outcomes, which might be dangerous to the nursing profession. Nursing competencies might be enhanced by the application of AI technology, allowing nurses to give more evidence-based and customized care to their patients (Clancy, 2020; and Chu, 2020)

Meanwhile, nurses' attitudes toward AI play an important role in accepting AI applications. For instance, Kwak, Ahn, & Seo, (2020) reported that a learner's positive attitude toward information technology (IT) reduced their anxiety about IT, promoted IT use or interactions, and improved confidence in problem-solving through IT. Additionally, attitudes toward IT affected emotions, behaviors, and ideas about IT, emphasizing the learners' importance of a positive attitude toward IT.

In this regard, according to Maag, (2017), nursing students must be computer literate and must show their proficiency with information management and patient care technology after finishing a four-year curriculum. Additionally, a high DHL level among nursing students and nurses improves access to accurate health information by utilizing effective web search techniques, encourages better coordination between nursing students and nurses in the delivery of care, and contributes to positive attitudes toward applications of artificially intelligent technology in the clinical setting of nursing students after graduation (Gurdas & Kaya, 2015).

Significance of the study:

Nurses and nursing students play a crucial role in introducing, implementing, and using technology in clinical practices, and possessing digital literacy upon completing nursing baccalaureate studies is crucial (Nes, Steindal, & Larsen, 2020). Digital and AI literacy is increasingly used in public communication (Spante, Hashemi, & Lundin, 2018) and it is a core requirement of students, academics, patients, and healthcare professionals due to the importance of technology in nursing education and practice (Terry, Davies, & Williams, 2019 and Harerimana & Mtshali, 2020).

In contrast, Kwak, Ahn & Seo, (2020) found that more than 70% of nurses and nursing students did not grasp AI in clinical practice. In addition, the study found that these emerging technologies pose challenges to nursing education in developing countries due to the lack of basic digital knowledge among nursing students. Particularly at the baccalaureate level and with poor infrastructure, lack of internet connectivity, and digital devices (Alhasan, et al., 2020; and Elsayed & Sleem, 2020).

The previous studies of Alhasan, et al, (2020); Elsayed & Sleem, (2020) and Ghotbi & Ho, (2020) reported that the low level of DHL or lack of digital skills among nursing students negatively impacts the ability of nurses and nursing students to access and use applications of digital health tools. While, Chen, et al, (2018) and Griebel et al., (2017) found that, a satisfactory digital literacy level at the bachelor level of the nursing program is a critical factor for academic success and future use of technology in nursing education and practice. Hence this would positively impact their ability to use applications of digital health tools and perform electronic documentation, communicate and collaborate, and search for information to support evidence-based practice and consequently, improve nursing students' attitudes, and intentions to use AI to educate future nurses to lead and adapt to these changes in technology in nursing.

Therefore, possessing digital health and AI literacy upon completing nursing baccalaureate studies is crucial. However, no previous research has mapped the existing studies of digital health literacy and the application of artificial intelligence among Egyptian nursing students and this data can become an eye-opener to decision and policymakers in learning health institutions to address these challenges. Therefore, this study was conducted to measure digital health-literacy levels among baccalaureate nursing students and its relation to their perception and attitudes toward the application of artificial intelligence at the Faculty of Nursing - Cairo University.

Aim of the study:

The present study was conducted to measure digital Health-literacy levels among baccalaureate nursing students and its relation to their perception and attitudes towards the

application of artificial intelligence at the Faculty of Nursing - Cairo University

Research questions:

To fulfill the aim of the study, the following questions were formulated:

1. What are the levels of DHL as perceived by baccalaureate nursing students?
2. What's the baccalaureate nursing student's perception of the application of AI in nursing?
3. What are baccalaureate nursing students' attitudes toward the application of AI?
4. Is there a relationship between digital Health-literacy among baccalaureate nursing students and their perception and attitudes toward the application of AI in nursing?

Research design:

A descriptive correlational design was utilized to fulfill the aim of this study.

Sample:

A Convenient sample of baccalaureate nursing students who registered at the 4th academic level enrolled in the baccalaureate program in nursing sciences during the 1st semester-2019/2020 academic year who composed of (n= 128) nursing students classified as follows; (106) Egyptian students and (22) foreign students.

Setting:

The current study was conducted at the Faculty of Nursing – Cairo University

Data collection tools:

The current study data were collected using two tools as follows:

Tool I: Nursing Students' Perspectives on Artificial Intelligence AI Questionnaire; composed of two parts:

Part 1: Personal characteristics data sheet: It was developed by the investigators and includes; gender, age, and nationality. In addition, items related to characteristics of Digital Health Literacy including; devices most used to access the internet, frequency of internet use for any purposes, frequency of internet use for health purposes, the

usefulness of the internet in helping to make health decisions, the importance of internet to access health resources, perception of internet skills and attended any lectures on AI, and any other training in computing programming.

Part 2: Nursing Students' Perspectives on Artificial Intelligence Questionnaire: This questionnaire was developed by Oh, et al, (2019) and Abdullah & Fakieh, (2020) and modified by the investigators to assess the graduate nursing student's perception and attitudes towards the application of AI in health care. It is composed of (33 items) and divided into four main dimensions as follows; application of artificial intelligence in nursing education (18 items), artificial intelligence basic principles (3 items), artificial intelligence as a topic in nursing (3 items), and attitudes and feelings toward Artificial intelligence (9 items).

The scoring system was done using a five-points Likert scale ranging from strongly disagree (1) to strongly agree (5). The maximum possible total score will be (33-165). The perception level and attitudes toward the application of AI in healthcare among studied participants was considered high if the percent score was more than 50%, moderate if the percent score ranged from 35 to 50%, and low if the percent score was less than 35% (Abdullah & Fakieh, 2020).

Tool II: Self-administered Digital Health Literacy scale (DHLs): This scale was developed by Van der Vaart & Drossaert, (2017) and modified by the investigators to assess the graduate nursing student's combined knowledge and perceived skills about digital health literacy. It consists of 8 questions.

The scoring system was done using a five-points Likert scale ranging from strongly disagree (1) to strongly agree (5) to measure the level of digital health literacy among studied participants. The maximum possible total score will be (8-40). A higher score is indicative of higher self-perceived digital health literacy. The perception level was considered high if the percent score was more than 75%, moderate if the percent score ranged from 60 to 75%, and low if the percent score was less than 60%.

Tool validity:

The study questionnaires' content validity was determined by a jury of three experts, two professors, and one assistant professor from the Faculty of Nursing, Cairo University after English to Arabic translation. Each expert on the jury was asked to examine the instrument for content, coverage, clarity, wording, length, format, and overall appearance. Accordingly, no changes had been made.

Tool reliability:

The reliability test was calculated using Cronbach's alpha coefficient for the study sample questionnaires, which indicates that the reliability for nursing students' perspectives on the artificial intelligence questionnaire and digital health literacy instruments value was 0.85, 0.88 respectively which means they were highly reliable.

Pilot Study:

After the questionnaires' construction, the investigators conducted a pilot study included 10% of the studied sample (12 students) to test the applicability and visibility of the questionnaires and approximate the needed time to fill in them. Suggested modifications depending on the feedback gathered from the pilot were made. Time consumed for filling in questionnaires ranged between 10 and 15 minutes. Pilot sample was excluded from the study sample.

Ethical considerations:

An official letter was obtained from the Faculty of Nursing-Cairo University vice dean of students and education affairs upon a letter issued including the aim of the study, the study sample, and the investigators who collect the data. The study sample was informed that the study posed no risks or hazards. The investigators emphasized that participation in the study will be entirely voluntary and the study sample has the right to withdraw at any time without giving any reason. Measures were taken to ensure confidentiality, and they were informed that the data collected will be used only for the purpose of the study.

Procedure:

After the official letter was obtained, the investigators used an electronic questionnaire on

the perspectives of baccalaureate nursing students toward artificial intelligence by using the open-source "Google Forms" platform and were distributed to all baccalaureate nursing students at the Faculty of Nursing - Cairo University, who registered the 4th academic level- 1st semester at 2019/2020 academic year using a unique link to the online investigation. Participation was voluntary and participants were informed about the goal of the study in the preface of the questionnaire. All responses were anonymous and participants could not be identified from the material presented. Responses were not recorded unless the "submit" button at the end of the questionnaire was pressed and only one submission per participant was allowed. In addition, the investigators handled the English form for the English speaker students and the Arabic form for Arab students to plot the answers in the questionnaire sheet. Data were collected over two months (January and February) during the 1st semester – 2019/2020 academic year.

Results:

Table (1) shows that more than half of the study's participants (60.2%) were female. Also, about age, it was found that (85.9%) of the participants' age group ranged from 20 < 23 years old. Moreover, the table clarifies that Egyptian students were greater than foreign (82.8% and 17.2%) respectively.

Table (2) Illustrates that less than three quarters of the students (72.7%) reported that, smartphones were their primary means of Internet use. Also (58.6%) reported that they used the Internet More than 3 times a day for any purpose, while only (45%) of them used the internet for health purposes on alternate days, followed by 18.0 Fewer than 3 times a day. Around (71.1%)

of them perceived that the Internet was very important to be able to access health-related resources. While (21.1%) of them reported that the Internet was Useful. However, (43.8%) of them perceived that they had an average level of Internet skills.

Table (3) clarifies that the student nurses moderately perceived all dimensions of digital Health literacy ($x\%=50.4\%$).

Figure (1) states that, the baccalaureate nursing students' perceived levels of digital Health Literacy ($n=128$). The figure illustrates that majority of nursing students perceived a moderate to high level of digital Health literacy (40.4%, 50.1%) respectively.

Table (4) clarify that the majority (73.8%) of nursing students perceived a moderate level of the overall application of artificial intelligence in nursing, with a higher mean score (80.4%) for Foreseen benefits of using artificial intelligence in nursing education and a lower mean score (65.9%) for students' Attitudes and feelings toward AI.

Table (5) show that there were no statistically significant differences between total scores of students' perception of AI, digital Health Literacy, and their personal characteristics.

Table (6) Depicts a statistically negative correlation between attitudes and feelings toward AI; foreseen benefits of using AI in nursing education and total digital health literacy with r value (-.059-, -.045- respectively). On other hand, there is no statistically significant correlation between total artificial intelligence in nursing and total digital health literacy at a p -value (0.735).

Table (1): Percentage distribution of baccalaureate nursing students' according to their personal characteristics ($n=128$).

Personal Characteristics		No.	%
Gender	▪ Male	51	39.8
	▪ Female	77	60.2
Nationality	▪ Egyptian	106	82.8
	▪ Foreign	22	17.2
Age	▪ 20 < 23	110	85.9
	▪ 23 ≤ 27	18	14.1
	Mean±SD	21.9 ± 1.7	
Do you attend any training in computing programming?	▪ Yes	38	29.7
	▪ No	90	70.3

Table (2): Percentage distributions of baccalaureate nursing students according to factors associated with the characteristics of Digital Health Literacy (n=128).

Characteristics Of Digital Health Literacy	No.	%
Perceived level of Internet skills		
▪ Poor	9	7
▪ Average	56	43.8
▪ Good	45	35.2
▪ Very good	18	14.1
Perceived importance of Internet		
▪ Not important	0	0
▪ Unsure	28	21.9
▪ Important	9	7
▪ Very important	91	71.1
Perceived usefulness of Internet		
▪ Not useful	18	14.1
▪ Unsure	81	63.3
▪ Useful	27	21.1
▪ Very useful	2	1.6
Frequency of using Internet for health-related purposes		
▪ Sometimes in a month	20	15.6
▪ Once a week	22	17.2
▪ Alternate days	58	45.3
▪ Fewer than 3 times a day	23	18
▪ More than 3 times a day	5	3.9
Frequency of Internet use for any purposes		
▪ Fewer than 3 times a day	33	25.8
▪ More than 3 times a day	75	58.6
▪ Sometimes	20	15.6
Devices most used to access Internet		
▪ Laptops	35	27.3
▪ Smartphone	93	72.7

Table (3): Percentage distribution of the baccalaureate nursing students according to Their perception of digital Health (n= 128).

Digital Health Literacy items	Agree		Disagree		Unsure	
	No	%	No	%	No	%
I know what health resources are available on the Internet	86	67.2	12	9.4	30	23.4
I know where to find helpful health resources on the Internet	98	76.6	16	12.5	14	10.9
I know how to find helpful health resources on the Internet	91	71.1	13	10.2	24	18.8
I know how to use the health information I find on the Internet to help me	87	68.0	15	11.7	26	20.3
I know how to use the Internet to answer my questions about health	80	62.5	23	18.0	25	19.5
I have the skills I need to evaluate the health resources I find on the Internet	72	56.3	18	14.1	38	29.7
I can tell high-quality health resources from low-quality resources on the Internet	27	21.1	49	38.3	52	40.6
I feel confident in using information from the Internet to make health decisions	40	31.3	28	21.9	60	46.9
Total Digital Health Literacy	Min	Max	Mean ± SD		\bar{x} %	
	14	24	19.59±2.09		50.4%	

Figure (1): Percentages distributions of the baccalaureate nursing students according to their level of perception of digital health literacy (n=128).

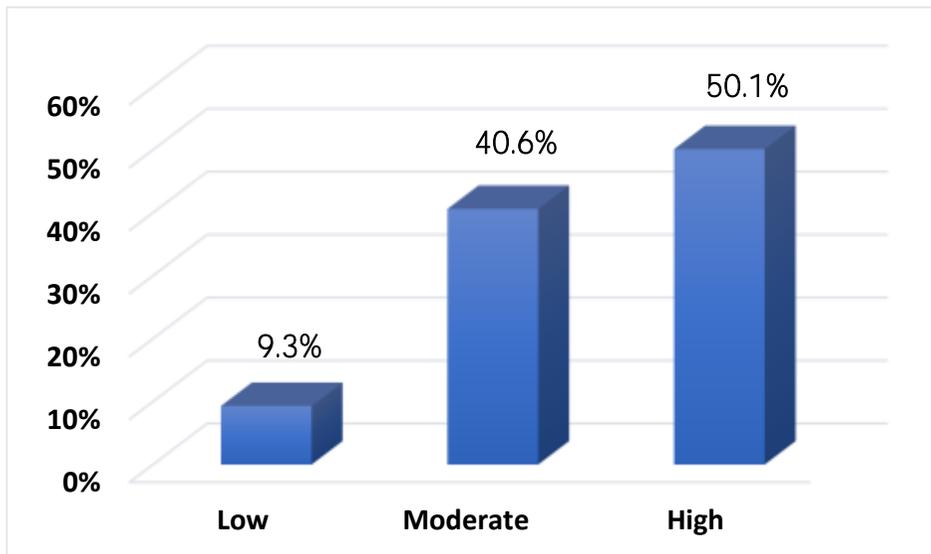


Table (4): Percentage distribution of the baccalaureate nursing students according to their perception of Application and attitude toward Artificial Intelligence in nursing (n=128).

Application of Artificial Intelligence in Nursing	High perception		Min-	Max	Mean±SD
	No.	%			
The benefits of using artificial intelligence in nursing	87	70.7	12	60	25.9 ± 7.08
Foreseen drawbacks of using AI in healthcare	89	72.4	9	33	18.6 ± 5.36
Foreseen benefits of using artificial intelligence in nursing education	99	80.4	3	15	5.7 ± 2.1
Foreseen drawbacks of using AI in nursing in education	98	79.6	6	24	11.6 ± 3.6
Attitudes and feelings toward AI	81	65.9	11	52	24.7 ± 6.5
Total	90.8	73.8	41	169	24.7 ± 19.05

Table (5): The relation between total scores of students' perception of AI, digital Health Literacy, and their personal characteristics (n=128).

Personal data	No.	Total score of the AI			Total score of digital Health Literacy		
		Mean±SD	T	P value	Mean±SD	T	P value
Gender							
Male	51	86.78±23.82	0.103	0.918	19.71±2.129	0.52	0.60
Female	77	86.42±15.26			19.51±2.081		
Age							
20<23 Years	110	87.11±19.560	0.803	0.423	19.69±2.035	1.40	0.162
23< 27 Years	18	83.22±15.633			18.94±2.388		
Do you attend any training in computing programming?							
Yes	38	86.00±26.33	-	0.860	19.79±1.455	0.713	0.477
No	90	86.81±15.14			0.178-		
Nationality							
Egyptian	106	87.12±16.69	0.719	0.474	19.60±2.073	0.21	0.83
Foreign	22	83.90±28.14			19.50±2.241		

Table (6): Correlation matrix between total scores of Artificial Intelligence (AI) in nursing and total scores of digital health literacy (DHL) among baccalaureate nursing students (n=128).

	Total digital health literacy	
	r	P
Total digital health literacy	1	
Total artificial intelligence in nursing	.030	.735
The benefits of using artificial intelligence in nursing	.098	.271
Foreseen drawbacks of using artificial intelligence in healthcare	.053	.553
Foreseen benefits of using artificial intelligence in nursing education	-.045	.615
Foreseen drawbacks of using artificial intelligence in nursing in education	.021	.813
Attitudes and feelings toward artificial intelligence	-.059	.509

Discussion:

Digital health literacy (DHL) has recently been proposed as a means of enabling healthy decisions for protective behavior, preventive measures, and adherence to policies and recommendations, especially in the era of "informatics. and, consequently, contributing to the sustainability of the healthcare system (Rodriguez et al., 2020). The current study was conducted to assess digital Health-literacy levels among baccalaureate nursing students and its relation to their perception and attitudes towards the application of artificial intelligence.

The study findings showed that more than half of the study participants were female and in relation to age, the majority of them ranged from 20<23 years old. Also, the majority of students were Egyptians and a minority of them were foreign.

According to factors associated with the characteristics of Digital Health Literacy; the current study showed that the majority of students reported that, the internet was very important to be able to access health-related resources and smart phones consider the primary mean for them to use the Internet. Also, the majority of them reported that they used the Internet during the day for any purpose, and about two third of them used the internet for health purposes during the day. This might be due to rapid changes in condition that had a serious impact on almost all aspects of our lives, including academics or education and the application of blended learning in the nursing faculties force students to use the internet.

This finding is consistent with a study by Sharma, Oli, and Thapa (2019), which found that, the majority of nursing students frequently accessed the Internet. Nearly a fifth utilized the internet frequently for health-related searches. Budhathoki, Pokharel, & Budhathoki (2016) In a similar line, research conducted in Jordan among undergraduate nursing students found that, they made extensive use of the Internet. In the same line, Tubaishat & Habibullah (2016) observed that, cellphones were the most popular way for nursing students to access the internet. Nearly 50% of respondents recognized the value and significance of using the Internet to find health resources and make health-related decisions (Sharma, Oli, &Thapa, 2019).

On the other hand, the previous findings incongruent with the results of a recent survey among Slovenian university students done by Gabrovec, et al., (2020) showed that they use the Internet for an average of 286 minutes per day during the week, or just under five hours per day.

As perceived by nursing students in the present study it was found that the majority of students have a moderate to high level of digital Health literacy. This may be because, with time, the rate of Internet usage is increasing; studying courses about nursing informatics in the faculty curriculum and rapid change of condition has had a serious impact on almost all aspects of our lives, including academics or education. For example, in the presence of COVID-19 every educational institution, from the lowest to the highest, is forced to adjust its way of delivering education.

So, it could be the cause of raising the level of digital Health Literacy.

This finding is congruent with research conducted by Sharma, Oli, and Thapa (2019) among Nepalese undergraduate nursing students who found that students still estimate their degree of E-health literacy to be at a moderate level. A systematic evaluation conducted by Stellesfson et al. (2011) among college students contradicts this claim, revealing insufficient e-health literacy abilities and poor capacity to use, detect, and evaluate health information online.

In relation to the application of AI as perceived by nursing students, the current study showed that the majority of student seen the benefits of using artificial intelligence in nursing education, and most of them had a higher perception regarding the application of artificial intelligence in nursing and their attitude and feeling toward artificial intelligence was moderate.

Students have different attitudes toward AI; in the first years of their training, they had fewer positive perspectives than upper-year students due to the increased clinical exposure in the later years of study (Abid, Awan, & Ismail, 2019 and Hack-Polay, Mahmoud, & Ikafa, 2020). Artificial intelligence (AI) is being used in more and more areas of the globe, making it crucial for all citizens to develop their AI literacy (Rababah et al., 2019; and Patil et al., 2020).

Other studies show that few faculty members or students claim to understand the fundamentals of AI technologies. However, professors and students are both very interested in receiving AI training on many themes (Oh et al., 2019; Abid, Awan, & Ismail, 2019). Similar findings reported by other researchers with medical students, Oh, et. al., (2019) and Sit, Srinivasan, & Amlani, (2020) residents, physicians (Park, et al., 2019) or medical students themselves; Ontario Medical Students Association, (2019) and Oh, et. al., (2019) indicated respondents recognized the importance of AI technologies in various clinical areas and were eager to participate in training.

Concerning students' perception of AI, digital Health Literacy, and their personal characteristics the present study showed that, there were no significant statistically differences between total scores of students' perception of AI, digital Health

Literacy, and their personal characteristics. It was congruent with a study done by Kong, Man-Yin Cheung, & Zhang, (2020) which found that the male and female participants showed no statistically significant differences in terms of their scores on the AI Concepts

On the other hand, Patil, et. al., (2020) noted that it is not surprising that young people had higher DHL than other population groups given experience. In addition to age, other sociodemographic elements including socioeconomic status (SES) and gender are linked to students' DHL. There is also conflicting information about gender differences in HL, with some research suggesting that women have higher HL than men (Rababah, et. al., 2019; Juviny, et. al., 2020, and Zakar, Zakar, & Fischer, 2020).

Regarding the correlation between total scores of AI and total scores of digital health literacy among baccalaureate nursing students the present study showed that there is no statistically significant correlation between total artificial intelligence in nursing and total digital health literacy. It was congruent with a study done by Kong, Man-Yin Cheung, & Zhang, (2020) which found that no significant differences were found in the participants' performance on the AI concepts test or the AI empowerment test, regardless of whether they had computer science-related backgrounds or other educational backgrounds.

Conclusion:

This study finding concluded that the majority of students had a moderate to high level of digital Health literacy. There was a higher perception among baccalaureate nursing students regarding the application of artificial intelligence in nursing and their attitude and feeling toward artificial intelligence was moderate. There was no statistically significant correlation between the total score of artificial intelligence in nursing and the total score of digital health literacy among baccalaureate nursing students.

Recommendations:

The following recommendations were made based on the findings of the study:

Improve digital competency among nursing students and nurses through the following:

- Develop an innovative undergraduate curriculum that includes opportunities for students to experience digital healthcare technologies such as AI to improve their digital competency and assist learners in its entry-level nursing programs access to the necessary digital tools.
- Integrate themes such as; artificial intelligence (AI) and healthcare digitization, which are becoming more and more important in the nursing curriculum.
- Training courses to improve the skills of nursing students about internet use.
- All nursing students need to acquire a wider range of skills, including fundamentals of digital literacy, genomics, AI, and machine learning, in addition to critical thinking skills and the construction of a continuous learning strategy.
- Further studies are needed to better define the mediating role of DHL across other factors.

References:

- Abdullah, R., & Fakieh, B. (2020).** Health Care Employees' Perceptions of the Use of Artificial Intelligence Applications: Survey Study. *Journal of medical Internet research*, 22(5),
- Abid,S., Awan, B.,& Ismail,T.(2019).**Artificial intelligence: medical student's attitude in district Peshawar Pakistan. *Pak J Public Health*. 9, pp 19-21.
- Alhasan,A., Audah,L., Ibrahim,I., Al-Sharaa,A., Al-Ogaili,A., Mohammed,J.(2020).**Case study to examine doctors' intentions to use IoT healthcare devices in Iraq during COVID-19 pandemic. *Int J Pervasive Comput Commun*.
- Chen,X., Hay, J., Waters, E., Kiviniemi, M., Biddle ,C., & Schofield, E.(2018).** Health literacy and use and trust in health information. *J Health Commun* 23(8); pp 24–34.
- Cho, H., Han, K., & Park, B. (2018)** Associations of eHealth literacy with health-promoting behaviors among hospital nurses: A descriptive cross-sectional study. *Journal of Advanced Nursing*, 74 (7), pp 1618– 1627
- Chu, C., Conway, A., Jibb, L., & Ronquillo, C. (2020).** The Impact of Digital Technologies, Data Analytics and AI on Nursing Informatics: The New Skills and Knowledge Nurses Need for the 21st Century. In *Nursing and Informatics for the 21st Century–Embracing a Digital World*, 3rd ed, Book 4, pp. 149-170.
- Clancy, T. (2020).** Artificial Intelligence and Nursing. *JONA: The Journal of Nursing Administration*, 50(3), pp 125–127.
- Elsayed, W., &Sleem, W. (2020).** Nurse managers' perception and attitudes toward using artificial intelligence technology in nursing settings. *Assiut Sci Nurs J*.;9(24):182–92. doi: [https:// doi. org/ 10. 21608/ asnj. 2021.72740.1159](https://doi.org/10.21608/asnj.2021.72740.1159).
- Fenech, M., Strukelj, N., & Buston,O.(2018).** Ethical, social and political challenges of artificial intelligence in health. In: *Future Advocacy*. Retrieved from: [https:// futureadvocacy. com/publications/ethical-social-and-political-challenges-of-artificialintelligence- in- health/](https://futureadvocacy.com/publications/ethical-social-and-political-challenges-of-artificialintelligence-in-health/). Accessed 8 February 2022.
- Gabrovec, B., Selak, Š., Crnkovič, N., Cesar, K., Šorgo, A., Raziskava ,O.(2020).** COVID-19 Med Student Journal.
- Ghotbi,N., & Ho,M. (2020).** Moral awareness of college students regarding artificial intelligence. *Asian Bioeth Rev*. 13(4), pp 21–33.
- Griebel, L., Kolominsky-Rabas, P., Schaller, S., Siudyka,J., Sierpinski,R.,& Papapavlou,D.(2017).** Acceptance by laypersons and medical professionals of the personalized eHealth platform, eHealth Monitor. *Inf Health Soc Care*.42(3),pp 32– 49. [https:// doi. org/ 10. 1080/ 17538157. 2016. 1237953](https://doi.org/10.1080/17538157.2016.1237953), eng.
- Gurdas Topkaya,S., Kaya,N. (2015).** Nurses' computer literacy and attitudes towards the use of computers in health care. *Int J Nurs Pract*.;21, pp 9-14.

- Hack-Polay, D., Mahmoud, A., & Ikafa, I. (2020).** Steering resilience in nursing practice: Examining the impact of digital innovations and enhanced emotional training on nurse competencies. *Technovation*..
- Harerimana, A., & Mtshali, N. (2020).** Using Exploratory and Confirmatory Factor Analysis to understand the role of technology in nursing education. *Nurse Education Today*. Retrieved from: 104490. PMID:32516637<https://doi.org/10.1016/j.nedt.2020.104490>
- Harerimana, A., & Mtshali, N. (2020).** Using mobile technologies among undergraduate nursing students for academic purposes in tertiary education: A quantitative survey. *CIN: Computers, Informatics, Nursing*. Published at: PMID:33259348 <https://doi.org/10.1097/cin.0000000000000694>
- Holt, K., Overgaard, D., & Engel, L. (2020).** Health literacy, digital literacy and eHealth literacy in Danish nursing students at entry and graduate level: a cross sectional study. *BMC Nursing*, 19, pp1-12. Retrieved from: PMID:32308559 <https://doi.org/10.1186/s12912-020-00418-w>.
- Juviny, D., Suñer-soler, R., Boixad, A., & Vernay, M.(2020).** Health Literacy among Health and Social Care University Students. *Int. J. Environ. Res. Public Health*, 17, pp 2273.
- Kim,G., Shin,Y.(2020).** Study on the development of a test for artificial intelligence ethical awareness. *J Korean Assoc Artif Intell Educ*. 2(1),pp 1–19.
- Kong,S. Man-Yin Cheung,W., & Zhang, G.(2020)** Evaluation of an artificial intelligence literacy course for university students with diverse study backgrounds. *J Computers and Education: Artificial Intelligence*.,2. Available at www.sciencedirect.com/journal/computers-and-education-artificial-intelligence.
- Kwak, Y., Ahn, J., & Seo, Y. (2020.)** Influence of AI ethics awareness, attitude, anxiety, and self-efficacy on nursing students' behavioral intentions, *BMC Nursing*,pp 21-26.
- Maag, M. (2017).** Nursing students' attitudes toward technology: A national study. *Nurse Educator*, 31(3), pp 112.
- Nes, A., Steindal, S., & Larsen, M. (2020).** Technological literacy in nursing education: A scoping review. *Journal of Professional Nursing*. 37(2), pp 320-340. Retrieved from: PMID:33867086 <https://doi.org/10.1016/j.profnurs.2021.01.008>
- Oh, S., Kim, J., Choi, S., Lee, H., Hong, J., &Kwon, S. (2019).** Physician Confidence in Artificial Intelligence: An Online Mobile Survey. *J Med Internet Res*. 21(3), pp 25.
- Ontario Medical Students Association. (2019).** Training for the future: preparing medical students for the impact of artificial intelligence.
- Park,S., Do,K., Kim, S., Park, J.,& Lim,Y.(2019).** What should medical students know about artificial intelligence in medicine? *J EducEval Health Prof.* , pp16-18.
- Patil, U., Kostareva, U., Hadley, M., Manganello, j, Okan, O., Dadaczynski, K., Massey, P., Agner, J.,& Sentell, T.(2020).**Health Literacy, Digital Health Literacy, and COVID-19 Pandemic Attitudes and Behaviors in U. S. College Students: Implications for Interventions. *Int. J. Environ. Res. Public Health* , 18.
- Pokharel., Budhathoki, S., & Pokharel, H. (2016).** Electronic Health Literacy Skills among medical and dental interns at B P Koirala Institute of health sciences. *J Nepal Health Res Counc.* ;14(3); pp 159–164.
- Rababah, J., Al-hammouri, M., Drew, B., & Aldalaykeh, M.(2019).** Health literacy: Exploring disparities among college students. *BMC Public Health* , 19, pp 1–12.
- Rajkomar,A., Dean,J., &Kohane,I. (2019).** Machine learning in medicine. *N Engl JMed.*;(3)80, pp 47–58.
- Rodriguez, J., Clark, C. and Bates, D. (2020),** "Digital health equity as a necessity in the 21st century cures act era", *Journal of the American Medical Association*, 323 (23), pp. 2381-2382.

- Ronquillo, C., Peltonen, L., Pruinelli, L., Chu, C., Bakken, S., Beduschi, A., & Cato, K (2020).** Artificial intelligence in nursing: Priorities and opportunities from an international invitational think-tank of the Nursing and Artificial Intelligence Leadership Collaborative. *J Adv Nurs*; 37(7); pp 17.
- Sharma, S., Oli, N., & Thapa, B. (2019).** Electronic health-literacy skills among nursing students. *Adv Med Educ Pract*. 10; pp 27–532. Available at [https:// www. ncbi. nlm. nih. gov/ pmc/ articles/ PMC6645068/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6645068/)
- Sit, C., Srinivasan, R., & Amlani, A. (2020).** Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicenter survey. *Insights Imaging*. 11(14).
- Spante, M., Hashemi, S., Lundin, M. (2018).** Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education*. 5(1).
- Stelleson, M., Hanik, B., Chaney, B., Chaney, D., Tennat, B., & Chavarria, E. (2011).** eHealth literacy among college students: a systematic review with implications for eHealth education. *J Med Internet Res*; 13(4)
- Terry, J., Davies, A., & Williams, C. (2019).** Improving the digital literacy competence of nursing and midwifery students: A qualitative study of the experiences of NICE student champions. *Nurse Education in Practice*. 34(19), pp 2-8.
- Topol, E. (2019).** High-performance medicine: the convergence of human and artificial intelligence. *Nat Med*, 25(1), pp 44–56.
- Tubaishat, A., Habiballah, L. (2016).** eHealth literacy among undergraduate nursing students. *Nurse Educ Today*. 42(July), pp 47–52.
- UNESCO. (2018).** A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2. Montreal, Quebec: UNESCO Institute for Statistics.
- Van der Vaart, R., & Drossaert, C. (2017).** Development of the Digital Health Literacy Instrument: Measuring a Broad Spectrum of Health 1.0 and Health 2.0 Skills. *J. Med. Internet Res*. 19(27).
- World Health Organization (WHO).** Geneva, Switzerland: WHO. (2018). Classification of Digital Health Interventions. Retrieved from: [https:// apps. who. int/ iris/ bitstream/ handle/ 10665/ 260480/ WHO-RHR-18.06-eng. pdf](https://apps.who.int/iris/bitstream/handle/10665/260480/WHO-RHR-18.06-eng.pdf) .
- Zakar, R., Zakar, M., & Fischer, F. (2020).** COVID-19 and Health Information Seeking Behavior: Digital Health Literacy Survey amongst University Students in Pakistan. *Int. J. Environ. Res. Public Health*, 18, pp 4009.