Data Literacy Skills of Health Information Management Professionals in Tertiary Hospital, Bayelsa State, Nigeria.

Ebimene Teddy Kurokeyi

Department of Health Information Management,

Niger Delta University Teaching Hospital

tedatnet1@gmail.com, kurokeyi.ebimene@lcu.edu.ng,

Phone Number: +234-7038585354

Oluwabunmi D. Bakare (Ph.D.)

Department of Information Management,

Lead City University

bakare.oluwabunmi@lcu.edu.ng

Phone Number: +234-8066365376

Abstract

Data literacy is the bedrock of every organizational decision support, as such health information management professionals is pivotal to this crucial role through constant interaction with patients on a daily basis. These roles can only be acted upon swiftly if they are data literate and competent. A situation whereby these factors are not in existence, there is every tendency that health information management professionals will face threat on their roles. It is against this backdrop this study considers it apt to investigate the data literacy skills (DLS) of health information professionals in tertiary hospitals in Bayelsa state. Descriptive research design was adopted. Population consists of 78 health information management professionals in tertiary hospitals in Bayelsa state. Total enumeration sampling technique was adopted as the sampling technique for this study. The reliability coefficient for each of the variables is 0.99, 0.98, 0.99, and 0.98. Data collected was analyzed using descriptive and inferential statistics. Findings revealed that, data gathering skill was more common with the highest mean, while other skills such as data storing, data processing and data visualizing skills were not common. The study concluded that data literacy skills of health information management professionals are low. In the shed light of this, the study recommended that organizational heads of tertiary hospitals and regulatory bodies should promote data literacy skills that will improve the quality healthcare data.

Key Words: Data Literacy skills, Tertiary hospitals, Health information management professionals (HIMPs).

Background

Data literacy skills of health information management professionals is the ability to interact, gather, manipulate and interpret data that suit the healthcare desire for information. The health information is an important compilation of facts about a patient's life and health, the ability to collect, manage, evaluate, and apply data in a critical manner (International Literacy Association, 2017). It includes documented data on past and present illness and treatment written by health care professionals caring for the patient (Zierler-Brown, et al. 2007). The health information must contain sufficient data to identify the patient, support the diagnosis or reason for attendance at the health care facility, justify the treatment and accurately document the results of treatment. The health information management professional's job description is concentrated on data; the transactional fact (data) requires literacy skills in data to manage patient care records. Decisions are informed by quality data collected, managed, evaluated, and applied to support evidence-based decisions that benefit citizens and increase knowledge

(Ridsdale et al. 2015). Data is now the world's currency of power in the digital economy (Ridsdale et al. 2015). It is an essential ability required in the global knowledge based economy; which the manipulation of data occurs in daily processes across all sectors and disciplines ((Ridsdale et al. 2015).

Data gathering skill is the ability to collect and collate data in a manual or electronic manner by measuring targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes. The health information management professional is the first point of contact to prepare the patient before proceeding to the next level of care, accuracy of data gathering is necessary to make informed business decisions, ensure quality, and maintain integrity because mistakes at this point affect' the entire healthcare management process (Lindén-Lahti et al. 2022). The health care sector is research based, as such at all times relies totally on accurate data. To meet these expectations on a daily basis, health information management professionals must have data literacy skills (Andrew et al, 2019). Also, data storage skills are vital to sustaining references and their usability (Andrew et al, 2019).

Data storage skill is the ability to prolong, extend, and sustain the continuity of data in futuristic terms for service users to ensure its availability of use. Health information management professionals, being the custodians of healthcare data, have a responsibility to maintain and archive the health information of patients in accordance with the records life-cycle model

(Lindén-Lahti et al. 2022). Data is often tracked and used by companies' everyday activities, such as credit card transactions, analytics from websites, or social media activity (Javaid et al, 2021). More so, data processing is the set of knowledge related to data skills expected of a health information management professional.

Data processing skill is the practice of analyzing, evaluating, interpreting, and distributing usable data securely, efficiently, and cost-effectively. The global economy is increasingly dependent on brainpower, our ability to process knowledge, and how people (health care providers) have ideas about the current situation in the healthcare sector (Büchi et al, 2020). The goods and services of our brainpower will be marketed in an increasingly competitive global village (Raghupathi, 2014). The health care industry depends absolutely on processed data readily available to sustain the overall decision process through data visualization (Raghupathi, 2014).

Data visualization skill is the ability to display data in a critical manner that draws logical and conclusive statements of facts and figures in tables, charts, histograms, and pie charts. The era of digital economy holds data in high esteem as gold mine, which compels health information management professionals to live up to expectations as data literates (Van Der Wel et al, 2019). Data generated are demographic characteristics, which consists of age, race, gender, ethnicity, religion, income, education, home ownership, sexual orientation, marital status, family size, health and disability status, and psychiatric diagnosis (Grillenberger & Romeike, 2018). Despite the substantial stimulus for the development of skills to handle data, the reality for most professionals does not seem to match the expectations of organizations, be it businesses in general, educational institutions, the academic community, or a variety of other stakeholders.

 Objectives

The objectives are to:

i. assess the data gathering skill of health information management professionals in tertiary hospitals in Bayelsa State, Nigeria.

ii. examine data storing skill of health information management professionals in tertiary hospitals in Bayelsa State, Nigeria.

iii. determine the data processing skill of health information management professionals in tertiary hospitals in Bayelsa State, Nigeria.

iv. examine the data visualizing skill of health information management professionals in tertiary hospitals in Bayelsa State, Nigeria

Literature Review

The data literacy competency model is composed of four elements: gathering, storing, processing, and visualizing data. However, the main constructs of this theory was expanded to include sub-constructs based on related literatures, such as data gathering (sources and purpose of data), data storage (retrieval, archiving, and preservation of data**),** data processing **(**conversion and manipulation of data), and data visualization (interpretation, analysis, and communication of data). The model consists of two intertwined areas that are interconnected based on practical and content-oriented factors. This model is on par with health information management professionals, who practically communicate and interact with data on a daily basis, with the need to be data skilled in both aspects to effectively manage, handle, and process data profitably. Data Gathering (Sources and Purpose of Data) is construct that takes into account the prerequisite of handling data (George, Osinga, Lavie, & Scott, 2016). However, from the researcher's view, some sub concepts and sub-terms can be considered that cannot be overruled separately, such as data sources and data purpose. The data source takes into consideration data attributes needed to be captured and the source to get the required data.

Data storing (retrieval, archiving, and preservation of data) is on the storage of and access to data, hence concepts that are particularly related to data management but also considered relevant to data science. Contextualizing Data storing, securing data, data archiving, and data presentation is contextualized on the basis of data preservation for future use (Abilock & Ballard et al, 2017, Mandinach, Ellen & Gummer, 2016). A relevant term, "management of data quality," is also used (Babu, Niehaus & Shah et al, 2019). As the very concept of privacy might be under threat, individuals need to be aware of their rights and how they can secure their data, especially online (Acquisti et al, 2010). Data Processing **(**Conversion and Manipulation of Data) involves evaluating data, which starts with understanding data and discerning its value suitable for decision-making (Wolff & Gooch et al., 2016). Although it is simpler to interpret data accurately when background information about data is provided, being data literate also means being able to develop hypotheses accordingly and to find correlations that are not easily apparent (Zhu & Schober et al, 2015; Weintrop & Beheshti et al, 2016). Data processing competency skills take a retrogressive step backward; the need to go through a process known as data cleaning, which

is the process of detecting and removing errors and inconsistencies from data in order to improve the quality of data (Guler, 2019). Data literacy is important as it makes realizing the structure and potential patterns in datasets easier and more apparent (Zhu & Schober et al, 2015; Wilson, 2017).
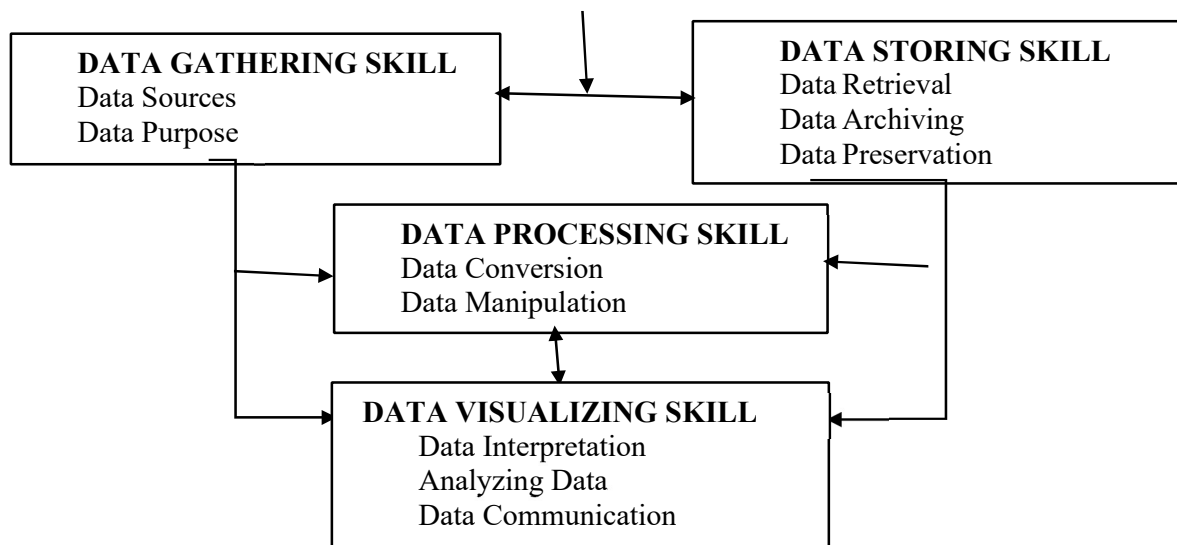
Data Visualizing (interpretation, analysis, and communication of data) is considered a "rich" aspect of data literacy (Mandinach, Honey & Light, 2006). Data visualization skills are focused on methods, algorithms, and principles that are central to analyzing data, making predictions, and communicating data based on phenomena of interest. An example from the 2016 US elections makes for a stunning analysis of this case (Ikemoto, Schuyler and Marsh, 2007). Datadriven decision making (also known as data-based decision making) is where data literacy is put into action and data is implemented, meaning that data is turned into information, then knowledge, and finally, a decision is made accordingly in the end (Jerome & Aaron, 2016; Garcia & Espinoza et al, 2013; Oyinade, 2017).

Figure 1. Conceptual Model for Data Literacy Skills.

DATA LITERACY SKILLS

Methodology

The study adopted descriptive research approach; this method became very necessary due to the nature of the problem and issue under investigation, which demand in-depth knowledge to explore the data literacy skills of health information management professionals in tertiary

DATA GATHERING SKILL
Data Sources
Data Purpose

DATA STORING SKILL
Data Retrieval
Data Archiving
Data Preservation

DATA PROCESSING SKILL
Data Conversion
Data Manipulation

DATA VISUALIZING SKILL
Data Interpretation
Analyzing Data
Data Communication

hospitals in Bayelsa State, Nigeria. The population of this study consists of seventy-eight (78) health information management professionals in tertiary hospitals, which are composed of the Federal Medical Centre, Yenagoa, and the Niger Delta University Teaching Hospital, Okolobiri, Yenagoa, Bayelsa State. Patients were included in the study because they are the direct beneficiaries of health information management professional service delivery. All licensed health information management professionals practicing in tertiary hospitals in

Bayelsa state. While non-licensed personnel's working in the health information management departments in the both tertiary hospitals was excluded from the study. Data were collected from the respondents in the designated tertiary healthcare institutions, structured selfadministered questionnaire was adopted. The questionnaire was divided into five sections: (1) Section A: Socio-demographic characteristics of the respondents such as age, sex, religion, level of education, years of experience, unit of deployment (2) Section B: Data gathering (3) Section C: Data storing skill (4) Section D: Data processing skill (5) Section: Data visualizing skill.

Ethical considerations

The study was granted ethical approval from the Ethics and Research Committee of both tertiary healthcare institutions (NDUTH/REC/06/09/23). Verbal and Informed consent was also obtained from the respondent. The confidentiality of information collected was secured by restricting access to the data collected to investigator and research assistants. Anonymity of the respondents was ensured by not including personal details of the respondents in the instrument.

Results

Table 1: Demographic Characteristics of Respondents

	(FMC & NDUTH)	Frequency	Percentage
Sex	Male	33	25.7
	Female	45	35.1
	Total	**78**	**100**
Age Range	≤ 36 years	11	8.58
	36 - 45	50	39
	46 - 55	14	10.9
	56 - above	3	2.3
	Total	**78**	**100**
Level of Education	ND	59	46

	HND/BSC	16	12.5
	M.Sc.	2	1.6
	PhD	1	0.8
	Total	**78**	**100**
Years of Working Experience	1 - 5	10	7.8
	6 -10	30	23.4
	11 - 15	33	25.7
	16 - Above	5	3.9
	Total	**78**	**100**
Current Unit of Deployment	A/E	14	10.9
	GOPD	26	20.3
	CHOP	4	3.1
	Eye Clinic	3	2.3
	Clinical Coding/Indexing	4	3.1
	A/D	6	4.7
	Other Units	21	16.4
	Total	**78**	**100**

The above table presents the demographic distribution of respondents in the two tertiary healthcare facilities in Bayelsa State. It provides insights into their sex, age distribution, level of education, working experience, and current unit of deployment. The gender distribution shows that women dominate the profession in both tertiary hospitals. The age distribution of the respondents from both hospitals showed that they are knowledgeable, and within decisionmaking age to distinguish between good and bad in the routines of health information management practice. Furthermore, it proves that the majority of the respondents are very agile and full of life, meaning that they are still very active.

The educational dispositions of the study participants indicate majorly national diploma holders, showing that career progression in health information management profession begins with the National Diploma, More so, it suggests that fresh undergraduate are more enthusiastic and zealous without faulting the decisions of the top management. The work experience of the respondents presuppose that they have been in the health information management practice for quite some time, and may have wealth of expertise operating in the space of knowledge. As a result, there won't be room for prejudice because the participants are well informed and experienced; hence, they could effectively respond to the questions pertaining to this study.

The table shows that majority of the respondent are deployed to major service points where the bulk load of service delivery is demanded.

Data Gathering Skill	N	R	S	O	A	Mean	Std.
I understand the imperative of collecting reliable and dependable data	6 (7.5)	7 (8.8)	9 (11.3)	11 (13.8)	45 (56.3)	3.05	1.33
I collect patient data devoid of error	8 (10.0)	19 (23.8)	17 (21.3)	22 (27.5)	12 (15.0)	2.14	1.25
There is consistency in Data extraction among HIM	4 (5.0)	9 (11.3)	13 (16.3)	20 (25.0)	32 (40.0)	2.86	1.22
Sources of data collection is well understood?	4 (5.0)	9 (11.3)	13 (16.3)	20 (25.0)	32 (40.0)	2.86	1.22
I can effectively collect data manually	7 (8.8)	7 (8.8)	14 (17.5)	22 (27.5)	28 (35.0)	2.73	1.29
1 maintain quality data collection	10 (12.5)	11 (13.8)	17 (21.3)	17 (21.3)	23 (28.8)	2.41	1.34
Weighted Mean:						**2.68**	

Table 2. Respondents level of Data gathering skill (*n*=78).

Note: N, R, S, O and A depicts N=Never, R= Rare, S= Sometime, O= Often and A= Always

The table above presents a breakdown of the level of data gathering skill of the study respondents, indicating low level of data gathering skill among health information management professionals, 56.3% of the respondents always understood the imperative of collecting reliable and dependable data. In the same vein, 27.5% of the respondents indicate that they often collect patient data devoid of error: Meanwhile, 40.0% indicate that there is always consistency in data extraction among health information management professionals. Also, 40.0% expressed that they always understand the sources of data collection. 28.8% of the respondents regarding effective collection of data manually. Furthermore, data from the respondents implies that 28.8% always maintain quality data collection. The weighted mean score for data gathering skill is 2.68, which indicates a high level of data gathering skill among health information management professionals in tertiary hospitals in Bayelsa state.

Table 3. Respondents level on Data storing skill (n=78)

Data Storing Skill	N	R	S	O	A	Mean	Std.
I can effectively store data manually?	3 (3.8)	4 (5.0)	15 (18.8)	25 (31.3)	31 (38.8)	2.99	1.08
There are adequate data storage facilities in the hospital for use?	23 (28.8)	7 (8.8)	9 (11.3)	20 (25.0)	19 (23.8)	1.44	1.12

Note: N, R, S, O and A depicts N=Never, R= Rare, S= Sometime, O= Often and A= Always

I am well conversant with archival equipment used in the storage of data?	9 (11.3)	7 (8.8)	23 (28.8)	20 (25.0)	19 (23.8)	2.42	1.27
Retrieval of data is prompt based on equipment in use?	27 (33.8)	31 (38.8)	9 (11.3)	7 (8.8)	4 (5.0)	1.10	1.14
I do not have any difficulties locating data?	5 (6.3)	7 (8.8)	25 (31.3)	21 (26.3)	20 (25.0)	2.69	1.19 9
Data tracking system is highly efficient?	33 (41.3)	7 (8.8)	10 (12.5)	17 (21.3)	11 (13.8)	1.56	1.55
Weighted Mean:						**2.03**	

The third table is used to measure data storage skill, which showed that 38.8% of the respondents always effectively store data manually. However, 28.8% of the respondents indicated that there is adequate data storage facilities in the hospital for use. The findings in this statement proved that the shortfall in data storing skill is tied to the lack of sufficient manual storage facilities for patients' case notes. In like manner, 28.8% of the respondents were sometimes conversant with the archival equipment used in the storage of data. The item showed that 38.8% of the respondents rarely respond promptly to the retrieval of data based on the equipment in use. The responses on the item indicate a gap in the promptness of health information management professionals to deliver service based on the constraining factors, such as the above-mentioned responses from the respondents. Furthermore, 31.3% of the study respondents sometimes do not have any difficulties locating data, which affirmed that patients are most times frustrated due to the longer time used to retrieve their case note. In the same manner, 41.3% indicated that the data tracking system is never efficient, which butteries the data of the preceding statements. The weighted mean score for the data storing literacy construct is 2.03, indicating a low level of data storage skill among the respondents.

Table 4. Respondents level on Data Processing skill (n=78)

Data Processing Skill	N	R	S	O	A	Mean	Std.
Health care data is easily displayed to reflect the purpose for which it was collected?	8 (10.0)	13 (16.3)	10 (12.5)	23 (28.8)	24 (30.0)	2.54	1.36
Health care data is timely processed to allow for actionable decisions?	2 (2.5)	11 (13.8)	13 (16.3)	35 (43.8)	17 (21.3)	2.69	1.04 8
I can analyze data that for easy comprehension?	12 (15.0)	28 (35.0)	9 (11.3)	16 (20.0)	13 (16.3)	1.87	1.36
I can clean and transform data without close supervision?	14 (17.5)	27 (33.8)	14 (17.5)	14 (17.5)	9 (11.3)	1.71	1.28 0

	N	R	S	O	A		
Data processed by me is reproducible with consistency of result?	17 (21.3)	19 (23.8)	20 (25.0)	11 (13.8)	11 (13.8)	1.74	1.333
I analyze data to meet targeted information need?	15 (18.8)	27 (33.8)	11 (13.8)	12 (15.0)	13 (16.3)	1.76	1.379
Weighted Mean:						**2.05**	

Note: N, R, S, O and A depicts N=Never, R= Rare, S= Sometime, O= Often and A= Always

The third matrix for measuring data literacy skill is, on data processing skill of the respondents. The first item shows that 30.0% of the respondents shows that healthcare data is always displayed. Similarly, 43.8% indicate that health care data is often timely processed to allow for actionable decisions. Furthermore, 35.0% showed that they can always analyze data. Also, 33.8% of the respondents admitted that they rarely can clean and transform data without close supervision. Similarly, 25.0 % showed sometimes data processed by them is reproducible with consistency of result" Interestingly. Likewise, 33.8% indicated that they rarely analyze data to meet targeted information needs. Those who never consent are, however, in the minority, which means that a significant number of respondents can analyze data to meet targeted information needs. The weighted mean score of the measure on data processing skill is 2.05, which implies a low level of data processing skill among health information management professionals in tertiary hospitals in Bayelsa State, Nigeria.

Data Visualizing Skill	N	R	S	O	A	Mean	Std.
I can visualize data using charts, graphs and tables?	14 (17.5)	27 (33.8)	13 (16.3)	13 (16.3)	11 (13.8)	1.74	1.323
I can display healthcare data at ease?	15 (18.8)	24 (30.0)	15 (18.8)	15 (18.8)	9 (11.3)	1.73	1.296
I can accurately interpret data visualized?	12 (15.0)	20 (25.0)	14 (17.5)	13 (16.3)	19 (23.8)	2.09	1.425
Data presentation to users at all level is done often?	19 (23.8)	25 (31.3)	12 (15.0)	9 (11.3)	13 (16.3)	1.64	1.405
I take appropriate steps to display data for quick understanding?	12 (15.0)	30 (37.5)	16 (20.0)	11 (13.8)	9 (11.3)	1.68	1.233
Data elements are structured strategically?	11 (13.8)	10 (12.5)	10 (12.5)	17 (21.3)	30 (37.5)	1.81	1 , 29 0
Weighted Mean:						**1.78**	
Criterion Mean for all variable						**2.14**	

Table 5. Respondents level on Data Visualizing skill (n=78)

Note: N, R, S, O and A depicts N=Never, R= Rare, S= Sometime, O= Often and A= Always

The fourth measurement for data literacy skill is data visualization skill, which has 33.8% of the respondents showing they rarely visualize data using charts, graphs, and tables. Interestingly 30.0% of the study respondents can rarely display healthcare data at ease, while 25.0% can

rarely interpret visualized data accurately. Also, it showed that 31.3% of the respondents indicate that "data presentation to users at all levels is done often. Suggestively,

37.5% fall within the rare group of the respondents that take appropriate steps to display data for quick understanding, 37.5% of the respondents in the rare scale of measurement posited that data elements are structured strategically. On average, the weighted mean score for data visualization skill is 1.78, which indicates a low level of data visualization skill.

Discussion

The study showed that data gathering skill is more common and high among health information management professionals than other constructs of measuring data literacy skills on a scale of 1 to 5, with a weighted mean score of 2.68. Whereas data storing skill is shown to be low, with a weighted mean score of 2.03, data processing skill is found to be low, with a weighted mean score of 2.05, and data visualizing skill is also low, with a weighted mean score of 1.78. Even though, the mean scores of data literacy skills were just at the average level, data gathering skill was more prevalent than the others. The findings of this study has shown that the data literacy skills of health information management professionals are low, with a criterion mean of 2.14, which is in agreement with other studies, that there is a gap in data literacy, and that a theory-practice gap does exist (Borgman, 2017; Bertram et al, 2021). More so, the revealed findings from this study disavow the result of other authors assertion that health workers overall level of digital literacy was desirable, and health information management professionals have not experienced deskilling, which reimagined aligned with industry needs (Alipour, and Payandeh, 2022; Borgman, 2017). Therefore, the position of these study findings is argued on the ground that if patients are literate in health information and general literacy, they can hold the health information management professionals accountable for processing their data accurately for better service delivery. The foundation for data literacy skills is personal coaching and training to overcome the obstacles faced by professionals (Babroudi et al, 2021). In all, this research findings shows that data gathering skill is more prevalent than other data literacy skills in tertiary hospitals in Bayelsa State. It is worthy to note that health information management professionals were primarily trained to gather and manage data.

Conclusion

Accurate data plays a vital role in the practice of health information management in the context of Data literacy skills. Data literacy skills involves data gathering, storing, processing and

visualizing skills in the practice of health information management in healthcare. The study has established that data gathering skill is high among the study respondents.

The challenges of healthcare decision making are evident of data literacy skills, and the access to quality data is critical in cutting costs and promoting collaboration among patient and health care professionals. Moreover, data literacy is directly linked to health information management professionals' ability to access, understand, appraise, and apply data. The expertise in data management is a prerequisite to navigate data task and resolve challenges of data queries. By leveraging on these skills, to effectively collect, organize, analyse, and interpret health data in order to provide accurate and reliable health information to healthcare providers, patients, and other stakeholders.

Recommendations

The following recommendations are hypnotized based on the findings of the study;

1. Health information management professionals should engage in life-long learning to develop their data literacy skills that aligns with the current digital era is in the stage of the data economy, and as such, the demand for data-literate professionals to survive the threat.

2. Self-motivation of professionals can encourage reskilling and upskilling of knowledge that will reduce the high level of job loss, employee turnover intension, and improve the level of employability.

3. Management of tertiary healthcare institutions should to provide annual budget for training and retraining of health information management professionals to local, national, and international scientific conferences, workshops, and symposiums to reskill their knowledge of international best practices and new innovations that can influence them for a positive competition.

References

Abilock, Debbie, D. Susan Ballard, Tasha Bergson-Michelson, Jennifer Colby, Catherine D'Ignazio, Kristin Fontichiaro, Lynette Hoelter et al. (2017). Data Literacy in the Real World: Conversations & Case Studies." *Maize Books.*

Abilock, Debbie, D. Susan Ballard, Tasha Bergson-Michelson, Jennifer Colby, Kristin Fontichiaro, Lynette Hoelter, Justin Joque et al. (2017). Creating data literate students." *Maize Books*.

Acquisti, Alessandro. (2010). The economics of personal data and the economics of privacy.

Alipour, Jahanpour, and Abolfazl Payandeh. (2022)."Assessing the level of digital health literacy among healthcare workers of teaching hospitals in the southeast of Iran." *Informatics in Medicine Unlocked,* 29, 100868.

Andrew,PS Damon,M. Paul. Pedersen, and D.Chad. McEvoy. (2019) Research methods and design in sport management. *Human Kinetics*.

Babroudi, Naeira Elyas Pour, Kamyar Sabri-Laghaie, and Nazli Ghanbari Ghoushchi. (2021)."Re-evaluation of the healthcare service quality criteria for the Covid-19 pandemic: Z-number fuzzy cognitive map." *Applied Soft Computing,* 112, 107775.

Babu, A. N., E. Niehaus, S. Shah, C. Unnithan, P. S. Ramkumar, J. Shah, V. V. Binoy, B. Soman, M. C. Arunan, and C. P. Jose. (2019). Smartphone geospatial apps for dengue control, prevention, prediction, and education: MOSapp, DISapp, and the mosquito perception index (MPI*)." Environmental monitoring and assessment*, 191, 1-17.

Bertram, Maja, Urs Steiner Brandt, Rikke Klitten Hansen, and Gert Tinggaard Svendsen. (2021)."Does higher health literacy lead to higher trust in public hospitals?." *International Journal for Equity in Health* 20, 1-15.

Büchi, Moritz, Eduard Fosch-Villaronga, Christoph Lutz, Aurelia Tamò-Larrieux, Shruthi Velidi, and Salome Viljoen. (2020).The chilling effects of algorithmic profiling: Mapping the issues." *Computer law & security review***,** 36,105367.

Christia, Jerome, and Aaron Ard. (2016)."The influence of demographic characteristics on service quality perceptions." *Journal of Marketing Management,* 4(2), 57-62.

Garcia, H. Cesar, E. Sara Espinoza, Michael Lichtenstein, and P. Helen Hazuda. (2013)."Health literacy associations between Hispanic elderly patients and their caregivers." *Journal of health communication,* 18(sup1), 256-272.

George, G., Osinga, E. C., Lavie, D., & Scott, B. A. (2016). Big data and data science methods for management research. *Academy of Management Journal*, *59*(5), 1493-1507.

Grillenberger, Andreas, and Ralf Romeike. (2018)"Developing a theoretically founded data literacy competency model*." In Proceedings of the 13th Workshop in Primary and Secondary Computing Education*, 1-10.

Guler, Gulsen. (2019). "Data literacy from theory to reality: How does it look?*." Vrije Universiteit Brussel, Brüssel.*

Ikemoto, Gina Schuyler, and A. Julie Marsh. (2007)."Cutting through the "data-driven" mantra: Different conceptions of data-driven decision making." *Teachers College Record*, 109(13), 105-131.

International Literacy Association. (2017). What's hot in literacy: *Report*.

Javaid, Mohd, Abid Haleem, Ravi Pratap Singh, Shanay Rab, and Rajiv Suman. (2021) "Internet of Behaviours (IoB) and its role in customer services." *Sensors International*, 2, 100122.

L. Borgman, Christine. (2017). Big data, little data, no data: Scholarship in the networked world. *MIT press*.

Lindén-Lahti, Carita, Sanna-Maria Kivivuori, Lasse Lehtonen, and Lotta Schepel. (2022) Implementing a new electronic health record system in a university hospital: the effect on reported medication errors. *In Healthcare* (MDPI), 10(6), 1020.

Mandinach, B. Ellen, and S. Edith Gummer. *(2016).* What does it mean for teachers to be data literate: Laying out the skills, knowledge, and dispositions." *Teaching and Teacher Education*, 60, 366-376.

Mandinach, B. Ellen, Margaret Honey, and Daniel Light. (2006)."A theoretical framework for data-driven decision making." *In annual meeting of the American Educational Research Association, San Francisco*, CA.

Ndukwe, Ifeanyi Glory, and Ben Kei Daniel. (2020)."Teaching analytics, value and tools for teacher data literacy: A systematic and tripartite approach**."** *International Journal of Educational Technology in Higher Education* 17(1), 1-31.

Oyinade, Tomori. (2017)."HEALTH CARE INFORMATION LITERACY THE ROLE OF LIBRARIANS.

Raghupathi, Wullianallur, and Viju Raghupathi. (2014).Big data analytics in healthcare: promise and potential." *Health information science and systems***,** 2, 1-10.

Ridsdale, Chantel, James Rothwell, Michael Smit, Hossam Ali-Hassan, Michael Bliemel, Dean Irvine, Daniel Kelley, Stan Matwin, and Bradley Wuetherick. (2015) "Strategies and best practices for data literacy education*: Knowledge synthesis report*.

Van Der Wel, Kjetil A., Olof Östergren, Olle Lundberg, Kaarina Korhonen, Pekka Martikainen, Anne-Marie Nybo Andersen, and Stine Kjaer Urhoj. (2019). A gold mine, but still no Klondike: Nordic register data in health inequalities research." *Scandinavian Journal of Public Health***,** 47(6), 618-630.

Weintrop, David, Elham Beheshti, Michael Horn, Kai Orton, Kemi Jona, Laura Trouille, and Uri Wilensky. (2016). Defining computational thinking for mathematics and science classrooms." *Journal of science education and technology***,** 25, 127-147.

Wilson, K. Graham. (2017)."Brexit, Trump and the special relationship." *The British Journal of Politics and International Relations,* 19(3), 543-557.

Wolff, Annika, Daniel Gooch, J. Jose Cavero Montaner, Umar Rashid, and Gerd Kortuem. (2016). Creating an understanding of data literacy for a data-driven society. *The Journal of Community Informatics,* 12(3).

Zhu, Jun, Robert Schober, and K. Vijay Bhargava. (2015). *Linear precoding of data and artificial noise in secure massive MIMO systems." IEEE Transactions on Wireless Communications*, 15(3), 2245-2261.

Zierler-Brown, Seena, R. Timothy Brown, David Chen, and Robert Wayne Blackburn. (2007) "Clinical documentation for patient care: models, concepts, and liability considerations for pharmacists." *American Journal of Health-System Pharmacy***,** 64(17), 1851-1858.