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Digital Health Information Literacy and Resource Utilization among Nursing Sandwich Students at University of Health and Allied Sciences

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Abstract

Digital health information resources are increasingly central to nursing education and clinical practice; however, variations exist in students' ability to use these resources effectively. This study explored how nursing sandwich students at the University of Health and Allied Sciences access and engage with digital health information, examined their skills in locating, evaluating, and applying such information, and identified factors influencing its effective utilization. A qualitative research design was employed. The study population comprised Level 200 to Level 400 General Nursing and Public Health Nursing sandwich students for the 2024/2025 academic year. Twenty participants were selected using convenience sampling. Data were collected through semi-structured interviews, audio-recorded, transcribed verbatim, and analyzed thematically using an inductive approach. Findings showed that all participants had access to digital devices and regularly used online resources. However, digital health information literacy varied considerably. Students with clinical exposure demonstrated stronger skills in evaluating and applying information, while others relied on general sources with limited critical appraisal. Key barriers included high data costs, unstable internet connectivity, time constraints, and limited formal training. The study concludes that although access to digital resources is widespread, gaps in skills and institutional support limit effective utilization. Strengthening practical digital literacy training and improving infrastructure are essential to support evidence-based nursing education and practice.

Keywords

Digital Health Information Literacy, Nursing Education, Sandwich Students, Information Resources, Qualitative Research

1. Background of Study

Digital technologies are transforming healthcare and education globally, as professional practice and learning are increasingly shaped by electronic information systems, online platforms, and data-driven tools [1]-[3]. In healthcare, the transition from paper-based records to electronic health records (EHRs) and other electronic medical systems illustrates this shift. Evidence from African contexts indicates that such systems can enhance access to patient information and reduce documentation errors, although adoption remains uneven across countries and facilities [3]. This transformation has direct implications for clinical practice, as nurses and other health professionals rely heavily on timely and accurate information to make decisions. EHRs and digital decision-support tools are designed to improve the accessibility and usability of such information within patient care workflows [3].

At the same time, nursing education is evolving to align with the digital transformation of healthcare. Many countries are incorporating informatics and digital competencies into nursing curricula, emphasizing the importance of information and communication technology (ICT) skills [1]. Nursing informatics courses commonly include topics such as health information systems, database use, regulatory frameworks, and scientific information retrieval, demonstrating that digital health information is both a clinical and educational priority [1]. However, the availability and depth of such training remain inconsistent, suggesting that many nursing students may not receive sufficient preparation for the digital demands of modern healthcare practice [1].

In the broader educational context, the COVID-19 pandemic accelerated the adoption of virtual learning systems. In Ghana, nursing and midwifery institutions rapidly transitioned from face-to-face instruction to online platforms, creating new learning opportunities but also exposing gaps in preparedness and support [2]. While students appreciated the flexibility of online learning, challenges such as limited orientation, poor connectivity, and reduced interaction hindered effective learning, particularly in practice-oriented disciplines like nursing [2]. Ghana's nursing and midwifery education system has also undergone broader digital transformation efforts aimed at improving training standards and addressing limitations of traditional systems. These efforts have involved regulatory changes, stakeholder engagement, and the introduction of digital tools and platforms [4]. However, the effectiveness of these initiatives depends on infrastructure quality, digital readiness, and ongoing support for both educators and students [2] [4].

Emerging technologies such as artificial intelligence further highlight both opportunities and challenges in digital health education. While such tools can support simulation-based learning and personalized instruction, their implementation is constrained by connectivity limitations, digital literacy gaps, and ethical concerns related to data governance. Overall, the increasing reliance on digital systems in both healthcare and education underscores the need for individuals to develop strong competencies in accessing, evaluating, and applying digital health information effectively [1] [3] [4].

Digital health information literacy refers to the ability to locate, critically evaluate, and effectively use digital health information. This competency is increasingly recognized as essential in nursing education, where students are expected to engage with digital resources during training and apply evidence-based knowledge in clinical settings [1] [3]. Nursing informatics curricula emphasize skills such as database searching, information management, and digital communication, reflecting the growing importance of digital knowledge systems in healthcare practice [1]. However, Ghana's experience with digital education reforms suggests that both students and educators may lack adequate digital literacy skills, highlighting the need for continuous training and institutional support [4].

Nursing students access a wide range of digital resources, including academic databases, e-journals, learning management systems, and clinical technologies such as EHRs and decision-support tools [1]-[3]. Despite this availability, access does not always translate into effective use. Ghanaian students have reported barriers such as high data costs, unreliable internet connectivity, and limited interactivity in online learning environments, which reduce the overall effectiveness of digital resources [2]. These challenges are consistent with broader findings on Ghana's education digitalization, which identify infrastructure limitations, financial constraints, and digital literacy gaps as persistent barriers [4].

Evidence from African healthcare systems similarly shows that the presence of digital infrastructure does not guarantee utilization. Studies indicate that EHR usage remains low in some settings due to inadequate training, connectivity challenges, outdated systems, and resistance to change [3]. This gap between access and effective use reflects not only technical limitations but also users' confidence and competence. Training interventions, supportive policies, and improved system usability have been identified as key strategies for enhancing digital adoption and effectiveness [3].

A related pattern is observed in nursing education, where awareness of important clinical frameworks does not always translate into practical application. For example, studies in Ghana show that although many nursing students are aware of the Patients' Rights Charter, fewer have engaged with the actual document or applied it in clinical practice due to limited access and instructional emphasis [5]. This highlights a broader issue that digital health information literacy seeks to address: the gap between awareness, access, and effective application of knowledge. Similar concerns have been raised regarding gaps in legal and ethical training within nurs-

ing curricula, which may limit students' ability to make informed clinical decisions [6].

Clinical training models such as preceptorship programmes offer opportunities to bridge this gap by integrating academic learning with real-world practice. In Ghana, such programmes have been shown to enhance students' readiness for clinical practice, particularly when they include exposure to digital tools such as decision-support systems and emerging technologies [7]. Within the Ghanaian context, nursing education continues to evolve within a digitally transforming environment. However, persistent challenges such as limited infrastructure, inadequate training, and unequal access to digital resources continue to affect learning outcomes [2] [4]. These challenges are particularly relevant for sandwich students, who often balance academic responsibilities with work and family commitments. While existing literature acknowledges the presence of sandwich nursing programmes in Ghana, there is limited empirical evidence focusing specifically on how these students engage with digital health information resources.

This gap is significant because the unique circumstances of sandwich students may influence their ability to access, evaluate, and use digital health information effectively. Barriers such as limited time, inconsistent internet access, and insufficient training may reduce the practical benefits of digital resources, even when such resources are available. Therefore, there is a need for context-specific research to understand how digital health information literacy and resource utilization are experienced by this group. For these reasons, the present study seeks to examine digital health information literacy and resource utilization among nursing sandwich students at the University of Health and Allied Sciences, focusing on how access, skills, training, and contextual factors interact within a rapidly evolving digital healthcare and education environment.

Objectives of Study:

1) To explore how nursing sandwich students at the University of Health and Allied Sciences access and engage with digital health information resources for academic and clinical learning.

2) To examine nursing sandwich students' skills and experiences in locating, evaluating, and applying digital health information in their learning and practice.

3) To identify the individual, institutional, and technological factors influencing the effective utilization of digital health information resources among nursing sandwich students at the University of Health and Allied Sciences.

2. Methods and Materials

This study adopted a qualitative research approach to explore digital health information literacy and resource utilization among nursing sandwich students at the University of Health and Allied Sciences (UHAS). A qualitative design was appropriate as it enabled an in-depth understanding of students' lived experiences, perceptions, and practices regarding the access, evaluation, and application of digital health information within academic and clinical contexts. In this study, digital

health information literacy is defined as the ability to locate, critically evaluate, and effectively apply digital health information for learning and clinical decision-making. The study population comprised nursing sandwich students enrolled in the 2024/2025 academic year, including those in the BSc General Nursing and BSc Public Health Nursing programmes from Level 200 to Level 400, with an estimated total population of 800 students.

A total of 20 participants were selected using a convenience sampling technique. Participants were recruited from lecture venues within UHAS. Inclusion criteria required that participants be registered nursing sandwich students within the specified programmes and levels, and willing to share their experiences. Efforts were made to ensure variation in programme of study, level, gender, and working status to capture diverse perspectives. The sample size was considered adequate for qualitative inquiry, as data saturation was achieved when no new themes or insights emerged during the later stages of data collection.

Data were collected using a semi-structured interview guide comprising open-ended questions aligned with the study objectives, focusing on access to digital health information resources, digital health information literacy skills and experiences, and factors influencing resource utilization. Individual face-to-face interviews lasting between 30 and 45 minutes were conducted in quiet and convenient locations within the university environment. All interviews were audio-recorded with participants' consent and supplemented with field notes to capture contextual observations. Data were transcribed verbatim and analyzed using NVivo software through thematic analysis following Braun and Clarke's six-phase framework: familiarization with data, initial coding, searching for themes, reviewing themes, defining and naming themes, and producing the report. Coding was conducted by the primary researcher, and a codebook was developed iteratively. Themes were refined through continuous comparison across transcripts to ensure consistency and depth of interpretation.

To enhance trustworthiness, several strategies were employed. Credibility was strengthened through prolonged engagement with participants and careful interpretation of verbatim transcripts. Dependability was supported through a systematic coding process and clear documentation of analytical decisions. Reflexivity was maintained by acknowledging the researcher's academic role within the institution and minimizing bias through adherence to the interview guide and consistent analytical procedures. Although formal ethical approval was not obtained from an Institutional Review Board, permission to conduct the study was sought and granted by the relevant authorities at UHAS. Ethical principles were strictly observed throughout the study, including voluntary participation, informed consent, confidentiality, and anonymity. Participants were informed of their right to withdraw at any stage without consequence, and all data were securely stored and used solely for research purposes.

3. Findings and Discussion

This section presents the findings from the interviews conducted among nursing

sandwich students at UHAS. The results are organized according to the three study objectives and analyzed thematically. To maintain confidentiality, participants are identified as Interviewee 1 - 20. The findings reveal variations in digital health information literacy and resource utilization shaped by experience, access, and contextual constraints.

3.1. Demographic Characteristics of Respondents

Table 1. Demographic characteristics of respondents.

Demographics	Frequency	Percentage (%)
Total	***20***	***100%***
Age Group		
20 - 24 years	7	35%
25 - 29 years	7	35%
30 - 34 years	4	20%
35 - 39 years	2	10%
Gender		
Male	9	45%
Female	11	55%
Programme		
BSc general nursing	10	50%
BSc public health nursing	10	50%
Level of Study		
Year 2	7	35%
Year 3	9	45%
Year 4	4	20%
Working While Studying		
Yes	13	65%
No	7	35%
Computer Skills Level		
Beginner	6	30%
Intermediate	9	45%
Advanced	5	25%
Access to Digital Devices		
Yes	20	100%
No	0	0%

Note: Field Survey (2026).

From Table 1, a total of 20 respondents participated in the study. The majority were aged 20 - 29 years (70%), indicating a relatively young and active student

population, with a slightly higher proportion of females (55%) than males (45%). Participants were evenly distributed across programmes, ensuring balanced representation. Most respondents were in Year 3 (45%), suggesting moderate academic exposure. Notably, 65% were working while studying, which may influence their learning patterns and access to resources. Although all participants had access to digital devices (100%), computer skill levels varied, with most reporting intermediate proficiency (45%), highlighting potential gaps in advanced digital health information literacy.

3.2. Access to and Utilization of Digital Health Information Resources

3.2.1. Types of Digital Resources Used

Participants reported using a wide range of digital platforms, though the depth and quality of use varied significantly. A dominant pattern among less experienced participants was reliance on general search engines such as Google and informal platforms like WhatsApp and social media.

Several participants indicated:

"I mostly use Google and sometimes Google Scholar… I also use WhatsApp groups where classmates share links" (Interviewee 1)

Similarly, others relied on less formal sources:

"I only use Google and sometimes Facebook health pages" (Interviewee 3)

In contrast, more experienced participants, particularly those actively working in clinical settings, demonstrated use of specialized and authoritative databases:

"I use PubMed sometimes… and hospital guidelines shared by colleagues" (Interviewee 2)

"I use PubMed, WHO, and hospital e-library systems" (Interviewee 7)

This contrast highlights a clear divide between basic and advanced resource utilization, with clinical exposure strongly influencing access to higher-quality sources.

3.2.2. Frequency of Use

The frequency of digital resource use ranged from occasional to daily engagement. Participants balancing work and study reported more frequent usage due to clinical demands:

"I use digital resources almost daily because of my work" (Interviewee 2)

"I use digital resources daily… for clinical decision-making" (Interviewee 20)

In comparison, others used digital tools primarily during academic pressure periods:

"I use digital resources almost every week, especially during exams" (Interviewee 1)

"I use it mainly during exams and assignments" (Interviewee 10)

Access contexts were largely shaped by personal schedules and infrastructure limitations. Many participants depended on home environments and mobile data:

"I usually access materials at home… at night I use mobile data" (Interviewee 1)

Others utilized workplace opportunities:

"I access resources mostly at work during break time" (Interviewee 2)

This reflects the flexible but constrained nature of access among sandwich students.

3.2.3. Purpose and Application of Information

Digital resources were used for both academic and clinical purposes. Academic use included assignments, presentations, and exam preparation:

"I use it mainly for assignments and presentations" (Interviewee 4)

Clinical application was more prominent among working participants:

"I use information for clinical decisions and sometimes to teach junior nurses" (Interviewee 2)

Notably, some participants reported real-life implications of digital information use:

"I searched Google and found a blog… later realized… it was not fully accurate" (Interviewee 1)

Others demonstrated positive outcomes:

"A WHO article helped me manage a wound infection case more carefully" (Interviewee 2)

From the findings, participants in this study had reported using many digital health information platforms, but their choices had differed by experience and by whether they had active clinical exposure. Less experienced participants had mainly relied on general search engines (especially Google) and informal sharing spaces such as WhatsApp groups and social media pages, as shown in the interviews. This pattern had matched evidence from distance-learning library research: Coetzer and Mapulanga [8] had found that many adult distance learners had not used online library services and that Google had been a primary information source for a substantial portion of respondents, which suggested that search engines often competed with library gateways to vetted electronic resources. It also aligned with mobile-learning evidence from Ghana reported by Adzifome and Agyei [9], where most students had used mobile devices to access the internet for learning but where learning had not been strongly channeled through the institution's formal learning management system, implying that students often chose open web pathways rather than structured academic systems. Access conditions described by

participants (home study at night, reliance on mobile data, and opportunistic workplace access during breaks) had also resembled Ng's [10] conceptual account of online distance learners, which had argued that learning spaces had been embedded across home, workplace, and other settings, and that access had been constrained by the location of connectivity and the limits of data services. In parallel, multiple studies had shown that weak infrastructure and unequal access had shaped digital participation: Ibrahim *et al.* [11] had reported that internet faults, limited bandwidth, and device availability problems had hindered blended learning feasibility, while (Noor) Coutts *et al.* [12] had similarly noted that emergency remote education had been affected by unstable Wi-Fi, electricity issues, and limited access to suitable equipment, with a risk of widened inequities. The reliance on mobile data described by participants had been consistent with Adzifome and Agyei's [9] finding that students had used both university Wi-Fi and personally purchased data (which increased learner costs), and it had echoed Coetzer and Mapulanga's [8] report that high data cost and login/password frustrations had been major barriers to online library service use. Informal peer-to-peer tools mentioned in this study (notably WhatsApp) had also reflected broader patterns in studies. Oloke *et al.* [13] had described apprentices using WhatsApp and other platforms to coordinate learning and communication across university and work tasks during disruption. However, more experienced participants in this study, especially those already practising clinically, had reported using more specialised and authoritative sources such as PubMed, WHO resources, and hospital guideline systems. That divide had been plausible within a wider evidence base showing that digital engagement had depended on digital competence, role demands, and available institutional supports: Pearse and Scott [14] had emphasised that online learning effects had varied with digital competency, access to technology and connectivity, and the learner's broader work and home context, and (Noor) Coutts *et al.* [12] had reported that remote delivery had increased familiarity with technology for those able to participate.

Participants in this study had reported using digital resources at different frequencies depending on competing pressures, and the pattern had contrasted "daily use driven by clinical work" with "periodic use driven by exams and assignments". This difference had been consistent with Ng's [10] account that adult distance learners had often studied within constrained time blocks and across multiple settings rather than in a single, stable campus environment [10], and it had resembled disruption-era accounts where learners had combined employment duties with study using digital tools. Oloke *et al.* [13] had reported that apprentices had blended university requirements with workplace tasks and had relied on digital platforms for coordination, but they had also experienced challenges such as too much screen time and reduced contact with mentors. More broadly, Pearse and Scott [14] had reviewed evidence showing conflicting results on emergency remote teaching impacts, with common problems including poor connectivity, home distractions, reduced social interaction, and inequality in working space and device access, which helped explain why some participants

in this study had concentrated their digital searching around high-pressure academic periods rather than sustaining it continuously. This study also found that participants had used digital information for both academic work (assignments, presentations, exam preparation) and clinical practice (decision-making and teaching junior colleagues), which was consistent with the general observation that remote and blended learning tools had been used to maintain learning continuity and workplace-linked performance during disruption, albeit unevenly due to infrastructure readiness and learner receptiveness [12]. At the same time, the interviews suggested that open-web searching had sometimes produced unreliable clinical information (e.g., a blog found via Google that was later judged inaccurate). That concern had cohered with Coetzer and Mapulanga [8] finding that distance users had experienced information overflow and had identified information literacy as a core library function, implying that learners needed skills and systems that helped them judge credibility, not only access content. The practical value of higher-quality sources in this study (e.g., WHO guidance supporting better wound-infection management) also fits the broader argument in health-workforce education that training quality depended on effective development arrangements and supportive systems, even though Pearse and Scott [14] had cautioned that outcomes varied widely with resources and context. Importantly, this study's frequent use of WhatsApp for sharing links had raised a second kind of risk beyond accuracy: governance and confidentiality in clinical communication. John *et al.* [15] review of guidance on BYOD messaging and third-party apps in the UK and Ireland had shown that many policies had discouraged or forbidden instant messaging apps for patient information exchange and that guidance had often lacked specific, actionable technical detail, leaving clinicians with uncertainty about safe configuration and platform choice [15].

3.3. Digital Health Information Literacy Skills and Experiences

3.3.1. Search Strategies and Information Retrieval

Search approaches varied widely. Less experienced participants relied on simple or unstructured methods:

"I just type full sentences in Google" (Interviewee 3)

"I type simple keywords like 'hypertension symptoms nursing'" (Interviewee 1)

Others used conversational queries:

"I just type questions like I'm asking a person" (Interviewee 6)

In contrast, more skilled participants demonstrated advanced techniques:

"I use structured keywords and medical subject headings" (Interviewee 7)

"Sometimes I copy diagnoses directly into PubMed" (Interviewee 2)

This indicates a gap in technical search competence across participants.

3.3.2. Evaluation of Information Credibility

Participants' ability to assess information credibility ranged from limited to highly sophisticated. Some relied on superficial indicators:

"I trust sources that end with .edu or .org… sometimes just what looks clear" (Interviewee 1)

"I trust anything that looks professional or has many views" (Interviewee 6)

Others admitted uncertainty:

"I don't really know how to judge reliability" (Interviewee 3)

Conversely, experienced participants emphasized authoritative sources:

"I trust WHO, CDC, and peer-reviewed journals" (Interviewee 2)

"I only trust peer-reviewed journals and WHO documents" (Interviewee 7)

This variation suggests inconsistent critical appraisal skills among students.

3.3.3. Confidence in Using Digital Health Information

Confidence levels were closely tied to experience and skill. Many participants expressed low to moderate confidence:

"I feel somewhat confident, but not fully" (Interviewee 1)

"I am not very confident" (Interviewee 10)

Others reported significant uncertainty:

"I feel not very confident" (Interviewee 3)

In contrast, participants with clinical exposure demonstrated high confidence:

"I feel very confident" (Interviewee 7)

"I feel confident but I always double-check" (Interviewee 5)

This highlights the role of practical experience in strengthening digital literacy.

3.3.4. Practical Experiences and Outcomes

Participants shared both positive and challenging experiences. Some described improved understanding and performance:

"I used a YouTube video to understand IV cannulation… it helped during clinicals" (Interviewee 1)

"A journal article helped me understand pressure ulcer staging better" (Interviewee 5)

Others highlighted limitations:

"Some of the information was not fully accurate" (Interviewee 1)

Despite challenges, digital tools were generally perceived as helpful in bridging knowledge gaps.

Participants in this study had reported very different ways of searching for digital health information, and these differences had looked like a clear gap in technical search competence. Less experienced students had tended to depend on Google and had used full-sentence or conversational questions, while more skilled students had used structured keywords, Medical Subject Headings, and databases such as PubMed. This pattern had matched how information literacy and digital literacy were described in earlier work: Deiniatur and Cahyono [16] had framed digital literacy as the ability to find information online and to judge it, and they had noted that learners used a mix of tools such as online academic databases and supporting software, but they still faced practical challenges that could limit effective searching and use of evidence. In a similar way, Satti *et al.* [17] had surveyed research scholars and had concluded that information literacy training should have been strengthened and formalized across education levels, because the ability to search for and use information properly had supported academic work and lifelong learning, yet many learners did not fully use databases and structured resources effectively. Our results also resembled nursing-focused evidence that "information literacy" skills could lag behind more basic "computer literacy": Le Roux *et al.* [18] had measured nursing informatics competencies and had reported that student competence increased by year level, but information literacy scores had not been as high as computer literacy scores, and limited formal training exposure had still been common.

Participants' credibility judgments and confidence in using digital health information had also varied widely, and these patterns had strongly aligned with prior concerns about how "untrained readers" assessed trustworthiness. Some participants had relied on surface cues (such as whether a website ended in ".edu/.org" or whether content looked "professional" or had many views), while others had said they did not know how to judge reliability, and a smaller group had privileged institutions (e.g., WHO, CDC) and peer-reviewed journals. This spread had echoed Eika and Sandnes's [19] findings that students without deep research training were influenced by simple reference "clues" (especially citation counts and publication recency) when deciding what to trust, and that educators might have needed targeted teaching to counter these biases. However, there had also been an important difference: Eika and Sandnes [19] had found that author names and publication origin were less influential cues than citations and recency, whereas several participants in our study had learned more on website domains, presentation quality, and popularity signals, suggesting that the specific "shortcut" cues students used could differ by context and platform (academic references versus general web pages). Concerns about accuracy had mattered for confidence as well. Participants who had described checking and double-checking information had resembled the stance promoted in training-focused research on emerging tools: Reading Turchioe *et al.* [20] had evaluated a brief educational intervention with doctoral nursing students using generative AI and had found that structured activities helped students identify strengths and limitations (including safety issues such as accuracy problems and hallucinations) and increased their self-rated com-

petency, which implied that guided appraisal practice could increase both skill and cautious confidence rather than simple trust. More broadly, the link between experience and confidence in our study, where participants with more clinical exposure had reported higher confidence had been consistent with nursing education studies arguing that additional workplace exposure could support readiness for practice: Park *et al.* [21], in a qualitative systematic review protocol, had described paid employment and health-related work during undergraduate study as routes to gain clinical experience beyond placements and had positioned this experience as potentially influential for the transition to practice (although the protocol itself had not yet provided synthesized outcome results). Evidence from competency measurement and training evaluations also supported the idea that confidence and capability increased with structured exposure: Le Roux *et al.* [18] had reported year-by-year increases in nursing informatics competency alongside curriculum mapping that revealed missing information-management content, implying that confidence gaps could be partly curricular and improvable through better integration.

3.4. Factors Influencing Digital Health Information Utilization

3.4.1. Structural and Technological Barriers

A major theme was infrastructural challenges, particularly internet access and device limitations:

"The Wi-Fi on campus is not reliable" (Interviewee 1)

"Network is not stable where I live" (Interviewee 6)

Participants in rural settings faced additional constraints:

"Internet is poor in rural area… device charging is also a problem" (Interviewee 8)

Limited access to devices also emerged:

"I don't have laptop" (Interviewee 6)

3.4.2. Financial Constraints

Cost of internet data was consistently identified as a major barrier:

"My biggest problem is data cost" (Interviewee 1)

"Internet bundles are expensive" (Interviewee 9)

Many participants relied heavily on personal data subscriptions:

"I usually use my personal data" (Interviewee 2)

This significantly limited continuous access to digital resources.

3.4.3. Time Constraints and Competing Responsibilities

Time limitations due to academic workload, employment, and family responsibilities were widely reported:

"Time and money affect me most… sometimes I am tired" (Interviewee 1)

"Workload is my biggest challenge" (Interviewee 2)

Participants with family responsibilities expressed additional pressures:

"Time and family responsibilities affect me most" (Interviewee 9)

These competing demands reduced opportunities for consistent digital engagement.

3.4.4. Institutional Support and Training Gaps

A recurring concern was the lack of structured training in digital health information literacy:

"We don't get enough training on how to search databases" (Interviewee 1)

"No formal training on digital research tools" (Interviewee 3)

While lecturers were generally perceived as supportive, their role was often limited:

"Lecturers are supportive but mostly theoretical" (Interviewee 2)

Participants emphasized the need for practical training:

"We need training on how to filter information online" (Interviewee 13)

3.4.5. Recommendations from Participants

Participants proposed several strategies to improve digital health information literacy:

Improved internet infrastructure:

"We need better Wi-Fi" (Interviewee 1)

Increased access to academic databases:

"We need better institutional access to journals" (Interviewee 7)

Flexible learning systems:

"We need flexible learning systems for working students" (Interviewee 5)

Practical training programs:

"We need digital literacy training for nursing students" (Interviewee 6)

These suggestions reflect a strong demand for systemic and institutional improvements.

Participants in this study described digital health information use as something that depended first on basic infrastructure, and their accounts showed that unstable internet and limited devices had reduced their ability to search and read health information ("The Wi-Fi on campus is not reliable"; "Network is not stable where I live"; "I don't have laptop"). This pattern matched what Urhiewhu *et al.* [22] reported among practising nurses in Northwest Nigeria, where poor internet con-

nectivity and power outages were key challenges and were linked with low use of electronic resources such as online databases and e-journals. It also resembled what Sackey *et al.* [23], a Ghana-focused scoping review, reported, where poor network infrastructure and erratic power supply were described as major barriers to implementing digital health technologies (noting that their work was a preprint and therefore had not yet been peer reviewed). Similar system-level limits were also reported outside Africa: Tinam-isan and Naga [24] analysis of Health Information Systems in Philippines highlighted infrastructure-related and human-resource difficulties, alongside financial problems that hindered development and maintenance of digital systems. In the same way, Kipruto *et al.* [25] (in a scoping review protocol) had argued that digital health interventions could not replace core health-system building blocks and that limited access, acceptability, and affordability of digital technology in populations had constrained the value of digital health for strengthening health systems. Financial barriers in our study were especially clear because participants repeatedly described internet bundles and data costs as their "biggest problem", which directly limited continuous access. This again aligned with Kipruto *et al.* [25] emphasis on affordability as a constraint on digital health use (while acknowledging their paper described planned review methods rather than final results) and it was consistent with Tinam-isan and Naga [24] finding that financial issues were major challenges for digital system development and maintenance in Philippines. Participants also described time pressure from workload, employment, tiredness, and family responsibilities, which reduced regular engagement with digital resources; this time-related barrier compared with Standaar *et al.* [26] qualitative study of people who attended a public-library eHealth course in the Netherlands, where "time" and "logistics" were discussed as participation barriers in the wider studies they reviewed, even though their own participants were often people who already had time, up-to-date devices, and comfort in the library setting. This contrast mattered because it suggested that even in a high-resource setting with free nonformal training opportunities, time and context still shaped who could take up support, while in our setting, time pressure occurred alongside connectivity and cost constraints that further restricted use [22] [25] [26]. Finally, participants' accounts showed clear institutional and skills gaps ("We don't get enough training on how to search databases"; "No formal training on digital research tools"; "We need training on how to filter information online"), and this echoed Nazeha *et al.* [27] scoping review of digital health competency frameworks, which reported that many frameworks emphasized basic IT literacy, health information management, and digital communication, and which stressed that digital health benefits depended on a workforce that was adequately trained. Our participants' concern about filtering and judging online information also aligned with Shi *et al.* [28] systematic review on Chinese older adults, which summarized that credibility perceptions of online health resources influenced eHealth literacy and that tailored training and support could address such modifiable factors noting that Shi *et al.* [28] focused on older adults, whereas our participants were stu-

dents, so the populations differed even if the skill issue was similar.

The findings suggested that digital health information utilization had been shaped by a chain of conditions: reliable connectivity and power, affordable access, available devices, adequate time, and practical skills support, and this sequence was consistent with how digital health was broadly described as the use of information and communications technology in support of health and health-related fields [27] and as a field focused on developing and using digital technologies to improve health [25]. Because digital health tools included things like eHealth platforms, telemedicine, and other digital applications, they required dependable access to devices and networks before users could benefit from them. Yet, the wider evidence suggested that these prerequisites were often unevenly distributed: Sackey *et al.* [23] noted that remote and underserved areas could benefit from mobile health and other digital tools, but they also emphasized that weak infrastructure and resistance to change had limited implementation (again, as a preprint, this evidence needed cautious interpretation). Urhiewhu *et al.* [22] showed empirically that when nurses' digital literacy was suboptimal, their use of online databases, e-journals, and decision tools was also low, and they recommended mandatory training, improved ICT infrastructure, and stronger institutional support. This study helped explain why our participants' recommendations focused on "better Wi-Fi", better institutional access to journals, flexible learning systems for working students, and practical digital literacy training: these suggestions directly targeted the same infrastructure, affordability, and support gaps described in Nigeria and Ghana, and the same institutional and financing barriers described in Philippines [22]-[24]. At the training level, Nazeha *et al.* [27] review implied that universities and health training institutions could have designed more structured learning by selecting competency domains that matched role and context, including basic IT skills, information management, communication, and awareness of ethical and privacy issues. Standaar *et al.* [26] findings added an important comparison: nonformal, supportive learning spaces (such as public libraries) had motivated learners and supported self-reliance, but participation still depended on resources like time, devices, and feeling comfortable in the setting, meaning that training offers alone did not remove structural barriers. Shi *et al.* [28] similarly indicated that eHealth literacy interventions needed tailoring to learners' backgrounds and that being taught how to use online resources could improve outcomes, which supported our participants' call for practical training on searching and filtering information rather than mainly theoretical support.

4. Conclusions

In conclusion, this study demonstrates that nursing sandwich students at UHAS actively engage with digital health information resources, yet their level of digital health information literacy varies considerably. While all participants reported access to digital devices and regular use of online resources, the depth, quality, and effectiveness of utilization were strongly influenced by clinical exposure, experience,

and contextual factors. Less experienced students tended to rely on general search engines and informal platforms, often with limited ability to critically evaluate information. In contrast, students with clinical roles showed greater competence in using specialized databases and evidence-based resources. Despite this variation, common challenges such as high data costs, unstable internet connectivity, time constraints, and limited formal training significantly restricted optimal use across all groups.

The findings have important implications for nursing education and practice. First, access to digital tools alone is insufficient; there is a clear need to strengthen students' competencies in searching, evaluating, and applying digital health information. Second, the gap between basic and advanced users suggests that current curricula may not adequately integrate practical digital literacy training. Third, the dual roles of sandwich students as learners and workers highlight the need for flexible, context-sensitive learning approaches that accommodate their unique constraints. Without addressing these issues, there is a risk that students may rely on inaccurate or low-quality information, which can negatively affect both academic performance and clinical decision-making.

Based on these findings, educational institutions should incorporate structured and practical digital health information literacy training into the nursing curriculum, with emphasis on database searching, critical appraisal, and evidence-based practice. Universities should also invest in reliable internet infrastructure and expand access to institutional databases and e-resources. In addition, flexible learning strategies, including asynchronous digital modules and mobile-friendly platforms, should be developed to support working students. Partnerships between universities and healthcare facilities should be strengthened to improve access to clinical information systems and ensure continuity between academic learning and clinical practice. For future research, studies should explore the effectiveness of targeted digital literacy interventions in improving students' competencies and outcomes. Longitudinal research could examine how digital health information literacy develops over time and influences clinical performance. Further studies may also compare different student populations or institutions to identify context-specific challenges and best practices.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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