International Journal of Advanced Research in Education and Society
e-ISSN: 2682-8138 | Vol. 7, No. 6, 12-26, 2025
https://asianscholarsnetwork.com/asnet-journals

A Multi-Dimensional Integrative Framework for Developing Disciplinary Information Literacy in Medical Undergraduate Education

Wang Haiying[1], Norhayati Hussin[1*], Ezza Rafedziawati Kamal Rafedzi[1]

[1] School of Information Science, Universiti Teknologi MARA (UiTM), 40150 Puncak Perdana, Selangor, Malaysia

*Corresponding Author: yatihussin@uitm.edu.my

Received: 1 October 2025 | Accepted: 24 November 2025 | Published: 1 December 2025

DOI: https://doi.org/10.55057/ijares.2025.7.6.2

Abstract: *The advancement of digital healthcare demands that medical students acquire competencies in disciplinary information literacy (DIL) surpassing basic digital skills, as current medical education lacks organized, research-supported frameworks that effortlessly integrate theoretical foundations with practical application strategies. This research introduces and confirms the effectiveness of a Multi-Dimensional Integrative Framework (MDIF) in improving DIL skills among medical undergraduates via evidence-based educational methods suitable for various educational environments, including those with limited resources. A methodical synthesis of conceptual frameworks was used, merging Social Cognitive Theory with Information Behavior Theory via an extensive review of literature from 2010-2024 and theoretical triangulation. Five pedagogical strategies based on evidence were pinpointed and corroborated through global case studies. The MDIF introduces a model grounded in theory, marked by the interplay of personal, environmental, and behavioral aspects. Five educational strategies are implemented: Problem-Based Learning, Case-Based Learning, Evidence-Based Practice, Blended Learning, and Technology-Enhanced Learning. This model offers adaptable implementation guidelines with relevant assessment instruments for practical use. It bridges the gap in theoretical-practical aspects of medical information literacy education, equipping educators and administrators with a flexible, evidence-based model for creating information-capable healthcare professionals in the changing digital healthcare environment.*

Keywords: disciplinary information literacy, medical undergraduate education, pedagogical framework, information behavior

---

1. Introduction

The rapid growth in medical understanding, along with the widespread incorporation of cutting-edge technologies into modern healthcare frameworks, has drastically altered the informational landscape facing healthcare professionals (Tegegne et al., 2023). Modern medical practitioners must integrate and scrutinize a variety of clinical data sources, including peer-reviewed studies, live electronic health records, AI-enhanced decision-making systems, and updated guidelines for clinical practice. In this complex information landscape, advanced digital skills are essential, surpassing traditional technical expertise and requiring more sophisticated abilities in critical evaluation, synthesizing evidence, and making clinical

decisions through technology (Giebel et al., 2025). Such a fundamental shift requires redefining medical education to develop graduates with advanced skills for strategic access, thorough evaluation, systematic integration, and judicious use of biomedical data in evolving, technology-driven healthcare environments. Medical training facilities ought to actively incorporate digital health literacy models, covering technical expertise, critical evaluation skills, ethical considerations in technology-driven care, and flexible learning approaches vital for adapting to the ongoing advancement of clinical knowledge and digital health breakthroughs (Sezer, 2020).

Despite information literacy is broadly recognized as a key factor in clinical proficiency, significant discrepancies remain in the practical application of theoretical models within medical education systems (Brennan et al., 2020). While basic information literacy teaching methods offer essential skills, they fall short in meeting the unique needs of clinical fields, where the precision of information is a key factor in patient safety, impacting diagnostic accuracy, treatment choices, and ultimately, the critical nature of life-or-death results (Bhoyar et al., 2024). Additionally, significant imbalances in educational facilities and technological assets unevenly affect settings with limited resources. Here, medical schools face complex challenges such as poor broadband access, inadequate digital gadgets, faculty's restricted digital skills, and limited financial means, critically impairing their ability to adequately equip students for modern, technology-focused healthcare (Hollimon et al., 2025). Latest comprehensive analyses and practical studies show that although healthcare facilities are progressively recognizing information literacy as an essential skill, its application is still significantly disjointed, often limited to solitary, non-curriculum-integrated library teaching sessions that do not offer long-term support and are ineffective in fostering continuous skill enhancement (Barr, 2023). Furthermore, current models show restricted effectiveness in settings with limited resources, characterized by poor digital infrastructure, such as inconsistent broadband connections, inadequate computing resources, exorbitant data expenses, and insufficient digital skills among faculty members (Barteit et al., 2020).

In response to these complex issues, the research introduces a Multi-Dimensional Integrative Framework (MDIF) aimed at methodically developing information literacy skills in various disciplines among medical students. MDIF offers extensive implementation advice, catering to a range of educational systems, resource availability, and unique cultural-pedagogical environments, thus guaranteeing its relevance in settings with both abundant and limited resources.

2. Literature Review

Over the last twenty years, academic discussions about information literacy in medical training have evolved significantly, marked by three separate stages of development (Veikkolainen et al., 2025). During the initial stage (2000-2010), the focus was mainly on developing fundamental tech skills and database management abilities, mirroring emerging initiatives to incorporate digital tools into medical education programs (Sezer, 2020). During the 2010-2020 specialization period, there was a rise in specialized information literacy frameworks tailored to specific disciplines, solidifying medical information literacy as a distinct academic field with specific educational needs and strict evaluation techniques (Brennan et al., 2020). The current phase of integration (2020-present) is marked by all-encompassing, system-oriented structures that seamlessly merge information literacy skills with clinical reasoning, evidence-based practice approaches, and comprehensive professional growth, thus redefining information

literacy as a crucial element of clinical proficiency instead of a supplementary skill set (Car et al., 2025).

Comprehensive analyses of interventions in medical information literacy consistently show a lack in theoretical foundation, innovative teaching methods, and extended assessment (Barbati et al., 2025). Initial strategies mainly focused on isolated library teaching models that highlighted technical database navigation abilities, instead of developing advanced cognitive skills such as critical evaluation, synthesis, and integrating evidence, which are crucial for making clinical decisions (Ullah & Ameen, 2019). Although modern methods have gradually integrated active learning techniques, most fall short in developing strong theoretical models that methodically tackle the intricate dynamics between cognitive functions, behavioral trends, and contextual elements influencing the evolution of information literacy. Crucially, current studies show significant methodological flaws: the primary focus on self-reported results undermines the evaluation of validity, the limited incorporation of objective performance indicators limits genuine skill assessment, and insufficient longitudinal monitoring hinders the comprehension of sustained retention patterns and the application of skills in real-world clinical settings (Lee et al., 2025).

Disciplinary information literacy (DIL) signifies a significant theoretical progression from broad, discipline-neutral information literacy models to more specific, based frameworks, acknowledging the unique knowledge frameworks, methodologies, and professional norms typical of certain academic and professional fields (Panahi et al., 2020). Particularly in the realm of medical education, DIL recognizes the fundamental differences in healthcare information practices compared to other fields, attributed to key elements such as the critical and impactful aspect of clinical choices where errors in information directly affect patient safety (Sutton et al., 2020). The rapid advancement and ongoing obsolescence of medical knowledge necessitate the ongoing enhancement of clinical skills (Bullock et al., 2020), along with the necessity to integrate diverse information sources, including patient-created wearable device data, sequencing outcomes, immediate physiological tracking, systematic review findings, clinical practice directives, and team-derived experiential insights, into unified, evidence-based diagnostic and treatment choices (Sutton et al., 2020).

Four interconnected areas form the core competencies in information literacy necessary for proficient healthcare (Gosak et al., 2025). Primarily, recognizing the need for information entails pinpointing significant knowledge voids in clinical settings and developing clear, addressable clinical inquiries through methodologies like PICO (Population, Intervention, Comparison, Outcome) or similar approaches, which methodically direct the gathering of evidence and minimize consistent mistakes in clinical investigations (Pearlman et al., 2024). Secondly, the pursuit of strategic information necessitates adept maneuvering through a variety of diverse information channels, such as specialized clinical databases (like PubMed), scholarly articles, guidelines for evidence-based clinical practice, and tools for decision-making at the point of care, all while thoroughly assessing the methodological advantages, organizational structures, and specific constraints of each type of resource (Sutton et al., 2020). Thirdly, thorough evaluation requires advanced skills to meticulously assess the quality of information by methodically examining research methods and designs, recognizing and measuring possible biases (such as selection, performance, detection, attrition, and reporting biases), employing suitable bias risk assessment instruments, and ascertaining the relevance and applicability of evidence to particular patient groups and clinical settings (Sasannia et al., 2022). Fourthly, the application of ethical information includes a thorough grasp of intellectual property rights and academic attribution methods, strict compliance with patient privacy laws (HIPAA, GDPR)

and principles of confidentiality, the conscientious incorporation of evidence into clinical decision-making while recognizing the intrinsic uncertainties and limitations of evidence, and the development of digital expertise in the realm of information dissemination (Chiruvella & Guddati, 2021). Rather than being isolated skills, these areas are interconnected and synergistic, evolving through consistent and intentional training in real clinical settings, thus requiring educational strategies that incorporate information literacy teaching over time across the medical syllabus using spiral learning models (Allouch et al., 2024).

3. Social Cognitive Theory as the Primary Theoretical Framework

The Social Cognitive Theory (SCT), initially developed by Bandura and later honed over many years of practical application, lays the groundwork for theoretical frameworks via its concept of triadic reciprocal determinism. This theory suggests that learning arises from ongoing, two-way, and evolving interplay between three interrelated factors: individual (cognitive-emotional), environmental (contextual), and behavioral (performance) elements. It challenges the notion of unidirectional linear causation by asserting that people are not independent entities or mere receivers of environmental variables, but actively shape their developmental paths by interacting with their environment (Bandura, 2001; Mukhalalati et al., 2022).

3.1 Personal Factors: Cognitive, Affective, and Biological Determinants

Within the realm of medical education, personal elements consist of a diverse array of cognitive abilities (encompassing previous knowledge in a field, understanding of educational tactics, and the ability to process information), emotional aspects (especially beliefs in one's own competence in information literacy and inherent drive to practice), and biological-physiological elements (Honicke et al., 2023). Self-efficacy, defined as a person's assessment of their ability to plan and implement necessary actions for achieving set performance goals, plays a pivotal role in enhancing information literacy (Yokoyama, 2024). Detailed empirical data shows that medical students with higher self-efficacy in information literacy show more determination in tackling intricate information-seeking challenges, utilize advanced and structured search techniques, exhibit superior critical evaluation skills, and attain better academic results than those with lesser self-efficacy (Huamán-Tapia et al., 2023).

3.2 Environmental Factors: Institutional, Technological, and Social-Contextual Influences

Environmental elements include a broad spectrum of institutional, technological, social, and cultural components that together form the educational environment where the development of information literacy occurs (Dwivedi et al., 2019; Rasdiana et al., 2024). Modern medical schools are influenced by several environmental factors, including: access to databases, digital libraries, electronic health record systems, and platforms for clinical decision-making; the quality of instructional design that integrates curriculum design and teaching methods; social support networks like peer learning networks, faculty mentorship, librarian consultations, and interprofessional team dynamics; and the degree to which evidence-based practice is valued, exemplified by faculty, incorporated in clinical rotations, and supported by evaluation systems (Naing et al., 2023). Studies reveal the significant influence of the environment on the development of information literacy: establishments with strong library facilities, longitudinally integrated structured education in information literacy throughout the syllabus, uniform examples of evidence-based information practices by faculty, and clinical learning settings that value critical investigation foster nurturing ecological niches for the ongoing practice, enhancement, and assimilation of information literacy skills (Shi et al., 2022).

3.3 Behavioral Factors: Observable Information Practices and Performance Patterns

The observable and quantifiable patterns of seeking information, methods of evaluation, synthesis techniques, and practical applications exhibited by medical students in various academic and clinical settings are encompassed by behavioral factors (Mattiazzi et al., 2024; Minghao et al., 2025). Importantly, in the context of SCT, these actions are not simply mechanical reactions to environmental triggers (unlike in behaviorist models), but are instead deliberate, purpose-driven actions influenced by individual cognitive-emotional elements such as anticipated outcomes, value assessments, and beliefs in one's own competence (Shell, 2023; Urhahne & Wijnia, 2023). For example, in response to a clinical inquiry, a medical student's genuine pursuit of information is influenced by their confidence in performing structured searches, their anticipations of the effectiveness of various information sources, environmental elements like time limitations and database availability, and previous reinforcement experiences (Barr, 2023).

3.4 Observational Learning and Modeling: Mechanisms for Information Literacy Acquisition

The focus of Social Cognitive Theory (SCT) on observational learning, also known as modeling or vicarious learning, offers vital understanding into the mechanisms by which medical students develop advanced information literacy skills via interactions with expert practitioners in real-world clinical settings. Observational learning, a fundamental aspect of SCT, happens as learners gain new insights and actions by watching others in social environments, influenced by cognitive processing, reinforcement, and modeling (Mukhalalati et al., 2022).

The four-phase observational learning model by Bandura provides a conceptual structure for grasping skill development in medical training. This model includes: processes where learners focus on key aspects of the behavior they observe; retention processes, where observed behaviors are symbolically represented and mentally practiced for future replication; reproduction processes, where symbolic representations are converted into tangible actions via physical and self-adjusting modifications; and motivational processes, where learners opt to perform learned behaviors in response to expected outcomes (Mukhalalati et al., 2022). The model sheds light on the intricate mental operations involved in learning skills from role models within clinical settings.

3.5 Wilson's Information Behavior Model

Wilson's Information Behavior Model (IBT) is one of the most influential theoretical frameworks in information science. Originally proposed in 1981, the model emphasized the contextual background of information needs, suggesting that information needs arise from an individual's role requirements within specific situations. In 1996, Wilson significantly revised the model by incorporating Stress/Coping Theory as a core mechanism and introducing concepts of activating mechanisms and intervening variables. The revised model posits that information-seeking behavior is influenced by multiple variables including personal characteristics (such as cognitive style and education level), interpersonal factors (social norms and authority influence), and environmental factors (information accessibility and resource constraints). The model's uniqueness lies in its comprehensiveness and explanatory power. It not only describes the information-seeking process but also deeply explores the psychological, social, and environmental mechanisms that influence information behavior, providing an important theoretical foundation for subsequent research.

4. Conceptual Framework Development: The Multi-Dimensional Integrative Framework (MDIF)

In terms of structure, the MDIF is centered on three interconnected elements that systematically apply Bandura's (1986, 2001) tripartite reciprocal determinism model from Social Cognitive Theory (Bandura, 1986), while also integrating Wilson's (1999, 2000) context-sensitive information behavior model to include distinct information practices specific to each field (Mukhalalati et al., 2022; Noble et al., 2025; Wilson, 1999; Wu et al., 2025).This theory's integration provides a comprehensive analytical viewpoint for examining information literacy development and developing evidence-based educational approaches, emphasizing various cognitive, behavioral, and environmental elements that affect information skill acquisition in medical education environments (Yuan et al., 2024).

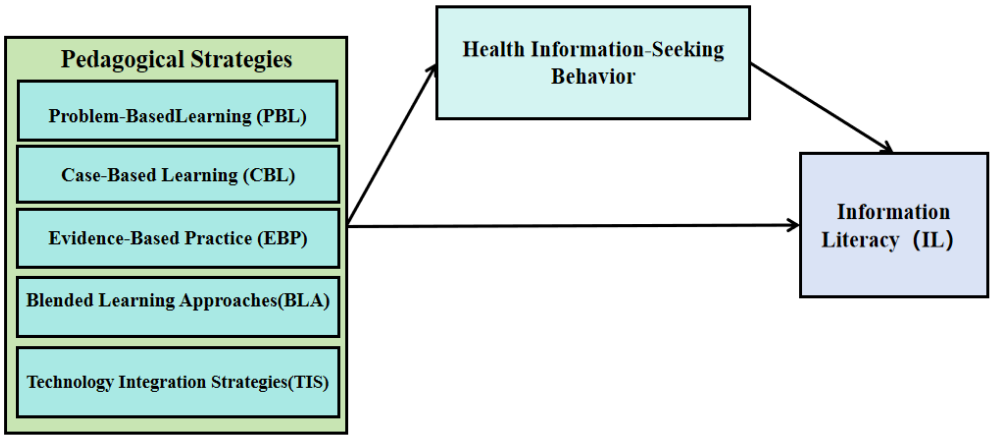

Figure 1: Basic Model from Bandura (1986) Social Cognitive Theory

The integration of these theories in a hierarchical manner creates a synergistic impact, where each framework enhances the other's explanatory strength, leading to a broader comprehension than what can be achieved independently by either theory. In particular, SCT's focus on self-efficacy beliefs, which is the specific confidence in one's ability to perform actions essential for achieving desired results, aligns with IBT's approach to assessing information needs. This helps clarify why students with higher levels of information self-efficacy are more likely to identify gaps in knowledge, start extensive information-seeking activities, and maintain involvement when faced with intricate, unclear, or conflicting data (Yuan et al., 2024). Such amalgamation sheds light on the necessity for teachers to not only teach technical skills but also to simultaneously cultivate students' beliefs in their own abilities, expectations of results, and a natural drive to participate in intellectually challenging information activities (Yong & Roberts, 2025).

Furthermore, IBT focus on analyzing information usage patterns seamlessly integrates with SCT's framework for observational learning, clarifying how medical students develop sophisticated skills in information evaluation and synthesis through methodical involvement in clinical cases and consistent observation of expert clinicians' informational methods in practical scenarios (Mukhalalati et al., 2022). Via this indirect learning approach, students gain procedural understanding of the information to pursue and also cultivate critical evaluation heuristics, strategies for synthesizing multiple sources, and frameworks for applying evidence. This is achieved by observing and mimicking seasoned practitioners who clearly demonstrate

these practices in clinical reasoning demonstrations and patient care discussions (Delavari et al., 2024).

Moreover, Social Cognitive Theory's emphasis on environmental factors as behavioral factors significantly enhances comprehension of how Information Behavior Theory recognizes the influence of context on information behavior. Concurrently, IBT investigates how the characteristics of a task, constraints in time, and the simplicity of obtaining information influence the patterns of information acquisition (Erfanian et al., 2024). SCT offers a conceptual structure for comprehending the intentional creation of educational settings by medical schools that methodically foster the growth of information literacy. This can be realized by strategically investing in technological frameworks, developing social support networks, and creating institutional cultures that overtly prioritize evidence-based methods, critical analysis, and ongoing education (Khani et al., 2023).

5. Evidence-Based Pedagogical Strategies

The MDIF amalgamates five thoroughly authenticated, empirically supported teaching methods, methodically chosen via an in-depth examination of global model practices and evaluation of their alignment with the framework's unified theoretical base (Chandran et al., 2023). Every approach focuses on unique but synergistic elements of developing information literacy across disciplines, jointly aiding in the complete amalgamation of competencies. This ensures that educational measures thoroughly tackle the diverse cognitive, behavioral, and situational facets of acquiring information literacy via synchronized, cooperative execution (Greenspan et al., 2025).

5.1 Problem-Based Learning (PBL)

Problem-Based Learning methodically utilizes genuine, context-specific clinical situations to cultivate advanced behaviors in seeking information, guided by constructivist learning tenets that focus on building knowledge through active participation in intricate issues (Su et al., 2025). During Problem-Based Learning (PBL), students participate jointly in diverse patient presentations, requiring extensive data collection from varied sources, thorough analysis of contradictory or unclear evidence, methodical integration of results across various evidence layers, and the use of collective knowledge to aid in logical clinical choices (Lim, 2023).

This method is tactically in sync with SCT's theoretical focus on education via genuine, context-specific problem-solving scenarios, where students simultaneously cultivate specialized cognitive skills and task-oriented self-belief by repeatedly engaging effectively with increasingly complex and lifelike clinical situations (Kubrusly et al., 2024). Concurrently, this mirrors IBT's conceptual emphasis on information requirements driven by context, recognizing that skills in information literacy are best developed when students need to methodically tackle distinct, clinically significant queries in their professional sphere (Martzoukou et al., 2024). Learning settings based on Problem-Based Learning (PBL) offer organized chances for joint knowledge building, where students witness and assimilate the varied information-seeking tactics of their peers, gain from diverse cognitive viewpoints in assessing and integrating evidence, and enhance their collaborative investigative skills via learning processes influenced by social interactions (Zhu & Zhang, 2023). Studies have shown that Problem-Based Learning (PBL) significantly improves the diverse skills of medical students in information literacy. This includes their ability to develop questions that are searchable and answerable in a clinical setting through organized methods like PICO (Population, Intervention, Comparison, Outcome), carefully choosing suitable information

sources and databases for their field, rigorously assessing the quality and pertinence of evidence, and judiciously utilizing integrated evidence in addressing intricate clinical issues in real-world settings (Trullàs et al., 2022).

5.2 Case-Based Learning (CBL)

Case-Based Learning utilizes meticulously selected, genuine clinical cases to methodically enhance skills in evidence assessment, critical evaluation, and clinical reasoning by analyzing actual patient cases (Bruen et al., 2025). Learners engage in thorough analysis of patient cases, scrutinize diagnostic methods, assess various treatment choices, and immerse themselves in medical texts, clinical directives, and factual data, whereas academic instructors offer organized educational assistance, allowing students to investigate alternatives, evaluate the quality of evidence, and delve into more profound cognitive analysis (Cen et al., 2021). Observational learning is enhanced in CBL settings, where educators can exemplify advanced information literacy skills via cognitive apprenticeship methods, articulate their reasoning during case studies to show how seasoned clinicians discern information requirements, choose suitable search techniques, rigorously assess the quality and relevance of evidence, and amalgamate integrated results into logical clinical reasoning processes (Burgess et al., 2021).

CBL's repetitive process methodically fosters the creation of illness scripts and improves the ability to recognize patterns. Students, through consistent engagement with cases that share similar clinical features but differ in complexity and viewpoints, acquire adaptable skills in information literacy in various clinical settings (Delavari et al., 2020). Research based on experience shows that CBL enhances medical students' ability to evaluate research using uniform methods, identify relevant evidence for diverse clinical question types, judiciously utilize evidence hierarchies, and amalgamate aggregated evidence with patient values, preferences, and clinical proficiency to aid in making informed clinical decisions (Yu et al., 2025).

5.3 Evidence-Based Practice (EBP)

Evidence-Based Practice fosters the development of comprehensive and systematic frameworks that integrate high-quality research outcomes with clinical insights, patient preferences, and values, thereby guaranteeing a comprehensive epistemological and methodological strategy in evidence-based medicine (Sasannia et al., 2022). Learners methodically enhance their skills in the five key stages of EBP, which include posing questions answerable in a clinical setting through organized methods like PICO (Population, Intervention, Comparison, Outcome), gathering data via effective literature review techniques, evaluating research methods and statistical evaluations using rigorous assessment procedures, utilizing integrated evidence in clinical judgments, and analyzing results to fine-tune their practice approaches (Bacchi, 2025).

This method tactically implements the framework's focus on synthesizing information, critically assessing, and applying clinical skills, thereby connecting the theoretical and practical divide between gathering information and making decisions based on evidence in clinical settings (Lee et al., 2020). Instruction in Evidence-Based Practice directly tackles the four key areas of information literacy in medical disciplines: obtaining information via methodical search techniques and strategies for choosing databases, assessing information through thorough critical analysis and quality evaluation, synthesizing information by merging evidence from various sources and levels, and ethically utilizing information by consciously acknowledging patient independence, common principles of decision-making, and honoring patient values and choices in clinical discussions (Hoffmann et al., 2022). The teaching

approach of Evidence-Based Practice (EBP) is tactically synchronized with both SCT and IBT, focusing on cultivating self-regulatory metacognitive abilities crucial for ongoing professional development and the preservation of skills throughout life, while also acknowledging the contextual, environmental, and systemic elements that significantly affect the application of evidence in various professional environments.

5.4 Blended Learning Approaches (BLA)

Approaches to Blended Learning tactically merge real-time in-person teaching with non-simultaneous digital learning tools to forge adaptable, learner-focused, and flexible educational settings, catering to a variety of learning requirements, tastes, and situational limitations (MacNeill et al., 2024). This teaching method directly tackles the environmental and individual elements outlined in SCT's three-way reciprocal determinism framework by offering a range of learning methods, technologically advanced materials, and versatile teaching styles, while also catering to diverse learning inclinations, timing limitations, pre-existing skill levels, and resource accessibility in various educational settings (Rojas-Estrada et al., 2024). Digital teaching elements can tactically integrate educational materials such as video demonstrations of methodical search techniques, engaging guides on critical evaluation methods with integrated formative evaluations, flexible quizzing systems offering instant, personalized feedback according to student performance trends, and non-simultaneous forums for student resource sharing, information-gathering tactics exchange, and participation in peer-assisted learning groups (Patil et al., 2025).

In environments with limited resources and resources, blended learning is crucial for educating about information literacy. It significantly lessens reliance on costly, exclusive databases by strategically integrating open educational materials, readily available repositories, and inventive commons resources. This approach also enhances the educational effectiveness of scarce faculty time and resources, utilizing asynchronous online teaching for uniform content distribution and allocating limited faculty time for meaningful interactive participation and personalized mentorship (Greenspan et al., 2025).

5.5 Technology Integration Strategies (TIS)

Strategies for Integrating Technology methodically integrate cutting-edge digital instruments and developing technologies to thoroughly improve access to information, analytical skills, and practical applications, thus equipping medical students for healthcare environments that are becoming more reliant on technology and data (Karimian et al., 2025). The educational aspect goes far beyond basic database exploration skills, including expertise in using AI for comprehensive literature analysis and merging evidence, clinical decision-making systems that seamlessly merge diverse patient data with existing research findings, mobile health apps for immediate access to information, and advanced data visualization instruments for deciphering and conveying intricate research outcomes (Pham, 2025). The educational focus is in harmony with Social Cognitive Theory's emphasis on autonomous learning and Information Behavior Theory's understanding of the need for information behaviors to evolve with changing information settings and technological capabilities. Importantly, TIS thoroughly tackles ethical and professional aspects of deploying health information technology, such as: comprehending the intrinsic constraints and possible algorithmic prejudices in AI-augmented clinical instruments; methodically assessing the trustworthiness, origin, and legitimacy of digital health data; and critically acknowledging the ways in which the design, execution, and accessibility of technology can mitigate or intensify current health inequalities, based on equity considerations and universal design tenets (Weiner et al., 2025).

6. Discussion and Implications

MDIF plays a crucial role in enhancing medical information literacy education both theoretically and practically. It methodically merges Constructivist Learning Theory with Social Cognitive Theory, offering a broader insight into the evolution of disciplinary information literacy (DIL). This comprehensive method tackles the shortcomings of single-theory models, which often focus solely on cognitive, individual, or social-contextual aspects, overlooking their interdependent dynamics (Varpio et al., 2020).

Initially, actionable advice for merging curricula is offered. MDIF delivers tangible, practical advice for medical teachers aiming to methodically incorporate information literacy skills into current curricula without the need for a complete curriculum overhaul. This includes incorporating various evidence-driven teaching methods, such as problem-solving learning situations that demand systematic evidence exploration, inverted classroom models for autonomous skill development, simulation exercises that incorporate information activities into clinical processes, and real-world learning experiences in the workplace that place information literacy in real-world clinical scenarios (Tordjman et al., 2025). Secondly, the deployment of MDIF fosters collaborative growth for faculty members. Its focus on dynamic learning techniques (such as case-based, problem-based, and team-based learning), tech-augmented teaching methods (including learning management systems, digital tools, and educational technologies), and cooperative teaching techniques aids in comprehensive institutional efforts to enhance educational quality throughout the medical program (Fedeli et al., 2025). Furthermore, the framework facilitates faculty communities of practice wherein educators collaboratively develop information literacy instructional materials, share evidence-based teaching strategies, engage in peer observation and feedback, and collectively solve challenges, thereby fostering a culture of continuous pedagogical improvement and educational scholarship (Flores et al., 2025).

7. Conclusion

The study introduces the Multi-Dimensional Integrative Framework (MDIF) as an approach grounded in theory and applicable in practice for developing disciplinary information literacy skills in medical students. By methodically merging Social Cognitive Theory with Information Behavior Theory, this framework fills significant gaps in current research and offers extensive directions for its application in various educational settings (He et al., 2024).

The deployment of MDIF aims to equip healthcare workers with advanced skills in information literacy, crucial for proficient functioning in technologically advanced healthcare settings. These skills encompass sophisticated abilities in evaluating evidence, synthesizing information, managing ethical data, and adapting to technological changes—skills that are becoming more vital as the healthcare sector progresses digitally. With ongoing technological progress, demographic shifts, and new public health issues, information literacy is set to be a key professional skill (Hollimon et al., 2025).

Acknowledgement
The authors would like to express sincere gratitude to everyone who contributed, both directly and indirectly, to the completion of this study.

Conflict of Interest Statement
The authors declare that there is no conflict of interest regarding the publication of this study.

References

Allouch, S., Ali, R. M., Al-Wattary, N., Nomikos, M., & Abu-Hijleh, M. F. (2024). Tools for measuring curriculum integration in health professions' education: a systematic review. BMC Medical Education, 24(1), 635.

Bacchi, A. D. (2025). Shared Decision Making: The Prerequisite for Substantial Autonomy in Evidence-Based Practice. Journal of Evaluation in Clinical Practice, 31(4), e70171.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. In: Prentice-hall.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. Annual review of psychology, 52(1), 1-26.

Barbati, C., Maranesi, E., Giammarchi, C., Lenge, M., Bonciani, M., Barbi, E., Vigezzi, G. P., Dragoni, M., Bailoni, T., & Odone, A. (2025). Effectiveness of eHealth literacy interventions: a systematic review and meta-analysis of experimental studies. BMC Public Health, 25(1), 288.

Barr, A. (2023). Initial efforts to improve medical student information-seeking behavior with embedded library instruction. Journal of the Medical Library Association: JMLA, 111(4), 823.

Barteit, S., Guzek, D., Jahn, A., Bärnighausen, T., Jorge, M. M., & Neuhann, F. (2020). Evaluation of e-learning for medical education in low-and middle-income countries: A systematic review. Computers & education, 145, 103726.

Bhoyar, A., Vagha, S., Mishra, V., Agrawal, M. S., & Kambala, S. R. (2024). Addressing the digital divide in health education: A systematic review. Cureus, 16(9).

Brennan, E. A., Ogawa, R. S., Thormodson, K., & von Isenburg, M. (2020). Introducing a health information literacy competencies map: connecting the Association of American Medical Colleges Core Entrustable Professional Activities and Accreditation Council for Graduate Medical Education Common Program Requirements to the Association of College & Research Libraries Framework. Journal of the Medical Library Association: JMLA, 108(3), 420.

Brottman, M. R., Char, D. M., Hattori, R. A., Heeb, R., & Taff, S. D. (2020). Toward cultural competency in health care: a scoping review of the diversity and inclusion education literature. Academic medicine, 95(5), 803-813.

Bruen, C., Illing, J., Daly, R., Meagher, F., Delany, C., Offiah, G., Doherty, S., Stuart, E., Crehan, M., & Kelly, H. (2025). Medical student experiences of Case-Based Learning (CBL) at a multicultural medical school. BMC Medical Education, 25(1), 152.

Bullock, J., Luccioni, A., Pham, K. H., Lam, C. S. N., & Luengo-Oroz, M. (2020). Mapping the landscape of artificial intelligence applications against COVID-19. Journal of Artificial Intelligence Research, 69, 807-845.

Burgess, A., Matar, E., Roberts, C., Haq, I., Wynter, L., Singer, J., Kalman, E., & Bleasel, J. (2021). Scaffolding medical student knowledge and skills: team-based learning (TBL) and case-based learning (CBL). BMC Medical Education, 21(1), 238.

Car, J., Ong, Q. C., Fox, T. E., Leightley, D., Kemp, S. J., Švab, I., Tsoi, K. K., Sam, A. H., Kent, F. M., & Hertelendy, A. J. (2025). The digital health competencies in medical education framework: an international consensus statement based on a Delphi study. JAMA network open, 8(1), e2453131-e2453131.

Cen, X.-Y., Hua, Y., Niu, S., & Yu, T. (2021). Application of case-based learning in medical student education: a meta-analysis. European Review for Medical & Pharmacological Sciences, 25(8).

Chandran, V. P., Balakrishnan, A., Rashid, M., Khan, S., Devi, E. S., Kulyadi, G. P., Nair, S., & Thunga, G. (2023). Teaching and learning strategies of evidence based medicine:

A meta-synthesis of learners and instructors perspective. Clinical Epidemiology and Global Health, 21, 101280.

Chiruvella, V., & Guddati, A. K. (2021). Ethical issues in patient data ownership. Interactive Journal of Medical Research, 10(2), e22269.

Delavari, S., Barzkar, F., MJP Rikers, R., Pourahmadi, M., Soltani Arabshahi, S. K., Keshtkar, A., Dargahi, H., Yaghmaei, M., & Monajemi, A. (2024). Teaching and learning clinical reasoning skill in undergraduate medical students: a scoping review. PloS one, 19(10), e0309606.

Delavari, S., Monajemi, A., Baradaran, H. R., Myint, P. K., Yaghmaei, M., & Arabshahi, S. K. S. (2020). How to develop clinical reasoning in medical students and interns based on illness script theory: An experimental study. Medical Journal of the Islamic Republic of Iran, 34, 9.

Dwivedi, A., Dwivedi, P., Bobek, S., & Sternad Zabukovšek, S. (2019). Factors affecting students' engagement with online content in blended learning. Kybernetes, 48(7), 1500-1515.

Erfanian, S., Maleknia, R., & Halalisan, A. F. (2024). Application of social cognitive theory to determine shaping factors of environmental intention and behaviors of ecotourist in forest areas. Frontiers in Forests and Global Change, 7, 1489170.

Fedeli, M., Liotino, M., & Taylor, E. W. (2025). New Faculty Development. Challenges and Opportunities for Implementing Teaching: The Case of University of Padova (Italy). New Directions for Adult and Continuing Education, 2025(187), 23-31.

Flores, M., Miquel, E., & Duran, D. (2025). Teacher collaborative knowledge building in Reciprocal Peer Observation. European Journal of Psychology of Education, 40(1), 45.

Giebel, G. D., Raszke, P., Nowak, H., Palmowski, L., Adamzik, M., Heinz, P., Tokic, M., Timmesfeld, N., Brunkhorst, F., & Wasem, J. (2025). Problems and barriers related to the use of AI-based clinical decision support systems: interview study. Journal of Medical Internet Research, 27, e63377.

Gosak, L., Štiglic, G., Pruinelli, L., & Vrbnjak, D. (2025). PICOT questions and search strategies formulation: A novel approach using artificial intelligence automation. Journal of Nursing Scholarship, 57(1), 5-16.

Greenspan, A. A., Goldberg, G., & Hamilton, K. L. (2025). Problem-based learning and digital platforms in medical education. Frontiers in Education,

He, Y., Wang, Z., Sun, N., Zhao, Y., Zhao, G., Ma, X., Liang, Z., Xia, S., & Liu, X. (2024). Enhancing medical education for undergraduates: integrating virtual reality and case-based learning for shoulder joint. BMC Medical Education, 24(1), 1103.

Hoffmann, T., Bakhit, M., & Michaleff, Z. (2022). Shared decision making and physical therapy: what, when, how, and why? Brazilian journal of physical therapy, 26(1), 100382.

Hollimon, L. A., Taylor, K. V., Fiegenbaum, R., Carrasco, M., Garchitorena Gomez, L., Chung, D., & Seixas, A. A. (2025). Redefining and solving the digital divide and exclusion to improve healthcare: going beyond access to include availability, adequacy, acceptability, and affordability. Frontiers in Digital Health, 7, 1508686.

Honicke, T., Broadbent, J., & Fuller-Tyszkiewicz, M. (2023). The self-efficacy and academic performance reciprocal relationship: the influence of task difficulty and baseline achievement on learner trajectory. Higher Education Research & Development, 42(8), 1936-1953.

Huamán-Tapia, E., Almanza-Cabe, R. B., Sairitupa-Sanchez, L. Z., Morales-García, S. B., Rivera-Lozada, O., Flores-Paredes, A., & Morales-García, W. C. (2023). Critical

thinking, generalized anxiety in satisfaction with studies: The mediating role of academic self-efficacy in medical students. Behavioral Sciences, 13(8), 665.

Karimian, Z., Salehi, N., & Moro, C. (2025). Intersecting Technological Pedagogical Content Knowledge and Artificial Intelligence in Medical and Health Sciences Education: A Perspective. Interdisciplinary journal of virtual learning in medical sciences (Online), 16(1), 1-7.

Khani, H., Ahmady, S., Sabet, B., Namaki, A., Zandi, S., & Niakan, S. (2023). Teaching-learning in clinical education based on epistemological orientations: A multi-method study. PloS one, 18(11), e0289150.

Kubrusly, M., de Aquino, B. O. A., Simonian, T. S., do Nascimento Oliveira, M., & Rocha, H. A. L. (2024). Self-efficacy of medical students in a hybrid curriculum course (traditional and problem-based learning) and associated factors. BMC Medical Education, 24(1), 9.

Lee, A. E., Ardissino, M., Bednarczuk, N. F., Tennyson, M., & Khajuria, A. (2020). Prospective assessment of a critical appraisal teaching programme on medical students' confidence and performance in appraising medical literature. Journal of the Royal College of Physicians of Edinburgh, 50(1), 60-66.

Lee, M. M., Lin, X., Lee, E. S., Smith, H. E., & Tudor Car, L. (2025). Effectiveness of educational interventions for improving healthcare professionals' information literacy: A systematic review. Health Information & Libraries Journal.

Lim, W. K. (2023). Problem based learning in medical education: handling objections and sustainable implementation. Advances in medical education and practice, 1453-1460.

MacNeill, H., Masters, K., Nemethy, K., & Correia, R. (2024). Online learning in health professions education. Part 1: Teaching and learning in online environments: AMEE Guide No. 161. Medical Teacher, 46(1), 4-17.

Martzoukou, K., Luders, E. S., Mair, J., Kostagiolas, P., Johnson, N., Work, F., & Fulton, C. (2024). A cross-sectional study of discipline-based self-perceived digital literacy competencies of nursing students. Journal of advanced nursing, 80(2), 656-672.

Mattiazzi, S., Cottrell, N., Ng, N., & Beckman, E. (2024). Behavioural outcomes of interprofessional education within clinical settings for health professional students: A systematic literature review. Journal of interprofessional care, 38(2), 294-307.

Minghao, P., Leyun, H., Jingying, Y., Wanyu, H., Fan, W., Linlin, W., & Meiyu, S. (2025). A grounded theory study on medical students' proxy online health information seeking behavior. BMC Public Health, 25(1), 339.

Mukhalalati, B., Elshami, S., Eljaam, M., Hussain, F. N., & Bishawi, A. H. (2022). Applications of social theories of learning in health professions education programs: a scoping review. Frontiers in Medicine, 9, 912751.

Naing, C., Whittaker, M. A., Aung, H. H., Chellappan, D. K., & Riegelman, A. (2023). The effects of flipped classrooms to improve learning outcomes in undergraduate health professional education: a systematic review. Campbell systematic reviews, 19(3), e1339.

Noble, C., Ajjawi, R., Billett, S., & Goldszmidt, M. (2025). How to approach qualitative observational research in workplace learning. The Clinical Teacher, 22(1), e70005.

Panahi, S., Mirzaei, A., & Bazrafshan, A. (2020). Disciplinary-based information literacy skills among medical students. Journal of education and health promotion, 9(1), 172.

Patil, N. G., Kou, N. L., Baptista-Hon, D. T., & Monteiro, O. (2025). Artificial Intelligence in Medical Education: A Practical Guide for Educators. MedComm–Future Medicine, 4(2), e70018.

Pearlman, O., Konecny, L. T., & Cole, M. (2024). Information literacy skills of health professions students in assessing YouTube medical education content. Frontiers in Education,

Pham, T. (2025). Ethical and legal considerations in healthcare AI: innovation and policy for safe and fair use. Royal Society Open Science, 12(5), 241873.

Rasdiana, R., Mauludin, I., Yahya, A., Putri, D., Machrus, M., Marbun, M., Sholikhah, A., Sinusi, N., Fathonah, S., & Salmayda, S. (2024). Mediation of digital literacy in investigating the effect of school culture on teacher performance: Implication for educational policy. Journal of Infrastructure, Policy and Development, 8(12), 9117.

Rojas-Estrada, E.-G., Aguaded, I., & Garcia-Ruiz, R. (2024). Media and information literacy in the prescribed curriculum: A systematic review on its integration. Education and Information Technologies, 29(8), 9445-9472.

Sasannia, S., Amini, M., Moosavi, M., Askarinejad, A., Moghadami, M., Ziaee, H., & Vara, F. (2022). Critical appraisal skills training to undergraduate medical students: A Randomized Control Study. Journal of Advances in Medical Education & Professionalism, 10(4), 253.

Sezer, B. (2020). Implementing an information literacy course: Impact on undergraduate medical students' abilities and attitudes. The Journal of Academic Librarianship, 46(6), 102248.

Shell, D. F. (2023). Outcome expectancy in social cognitive theory: The role of contingency in agency and motivation in education. Theory Into Practice, 62(3), 255-265.

Shi, Y., Peng, F., & Sun, F. (2022). A blended learning model based on smart learning environment to improve college students' information literacy. Ieee Access, 10, 89485-89498.

Su, T., Liu, J., Meng, L., Luo, Y., Ke, Q., & Xie, L. (2025). The effectiveness of problem-based learning (PBL) in enhancing critical thinking skills in medical education: a systematic review and meta-analysis. Frontiers in Education,

Sutton, R. T., Pincock, D., Baumgart, D. C., Sadowski, D. C., Fedorak, R. N., & Kroeker, K. I. (2020). An overview of clinical decision support systems: benefits, risks, and strategies for success. NPJ digital medicine, 3(1), 17.

Tegegne, M. D., Tilahun, B., Mamuye, A., Kerie, H., Nurhussien, F., Zemen, E., Mebratu, A., Sisay, G., Getachew, R., & Gebeyehu, H. (2023). Digital literacy level and associated factors among health professionals in a referral and teaching hospital: an implication for future digital health systems implementation. Frontiers in Public Health, 11, 1130894.

Tordjman, M., Liu, Z., Yuce, M., Fauveau, V., Mei, Y., Hadjadj, J., Bolger, I., Almansour, H., Horst, C., & Parihar, A. S. (2025). Comparative benchmarking of the DeepSeek large language model on medical tasks and clinical reasoning. Nature medicine, 1-1.

Trullàs, J. C., Blay, C., Sarri, E., & Pujol, R. (2022). Effectiveness of problem-based learning methodology in undergraduate medical education: a scoping review. BMC Medical Education, 22(1), 104.

Ullah, M., & Ameen, K. (2019). Teaching information literacy skills to medical students: perceptions of health sciences librarians. Health Information & Libraries Journal, 36(4), 357-366.

Urhahne, D., & Wijnia, L. (2023). Theories of motivation in education: An integrative framework. Educational Psychology Review, 35(2), 45.

Varpio, L., Paradis, E., Uijtdehaage, S., & Young, M. (2020). The distinctions between theory, theoretical framework, and conceptual framework. Academic medicine, 95(7), 989-994.

Veikkolainen, P., Tuovinen, T., Kulmala, P., Jarva, E., Juntunen, J., Tuomikoski, A.-M., Männistö, M., Pihlajasalo, T., & Reponen, J. (2025). The Evolution of Medical Student Competencies and Attitudes in Digital Health Between 2016 and 2022: Comparative Cross-Sectional Study. JMIR Medical Education, 11, e67423.

Weiner, E. B., Dankwa-Mullan, I., Nelson, W. A., & Hassanpour, S. (2025). Ethical challenges and evolving strategies in the integration of artificial intelligence into clinical practice. PLOS digital health, 4(4), e0000810.

Wilson, T. D. (1999). Models in information behaviour research. Journal of Documentation, 55(3), 249-270.

Wu, J., Zhang, Q., Gan, X., Liu, X., Hu, J., & Wang, Y. (2025). The relationship between digital literacy and innovative behavior among Chinese medical students: the chain mediating roles of diversity experience and creative self-efficacy. BMC Medical Education, 25(1), 1194.

Yokoyama, S. (2024). Impact of academic self-efficacy on online learning outcomes: a recent literature review. EXCLI journal, 23, 960.

Yong, J. L., & Roberts, G. (2025). Reflection and self-efficacy for clinical skills. The Clinical Teacher, 22(1), e13833.

Yu, Z., Zhao, Z., Chen, X., Shi, J., Liang, Y., Zhang, X., Qu, M., Huang, M., Li, P., & Li, D. (2025). Effects of standardised patients (SP) combined with case-based learning (CBL) in Chinese clinical education: a systematic review and meta-analysis. BMJ open, 15(9), e095705.

Yuan, X., Rehman, S., Altalbe, A., Rehman, E., & Shahiman, M. A. (2024). Digital literacy as a catalyst for academic confidence: exploring the interplay between academic self-efficacy and academic procrastination among medical students. BMC Medical Education, 24(1), 1317.

Zhu, M., & Zhang, K. (2023). Promote collaborations in online problem-based learning in a user experience design course: Educational design research. Education and Information Technologies, 28(6), 7631-7649.