Review

The Growing Importance of Soft Skills in Medical Education in the AI Era: Balancing Humanistic Care and Artificial Intelligence

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The Growing Importance of Soft Skills in Medical Education in the AI Era: Balancing Humanistic Care and Artificial Intelligence

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Abstract

As artificial intelligence transforms clinical practice, it is essential for medical education to incorporate soft skills to ensure patient safety, support transparent decision-making, and uphold ethical accountability. This narrative review synthesizes evidence from MEDLINE, Scopus, Google Scholar, and grey literature, organizing the findings into seven thematic areas that cover curriculum integration and teaching methods. The results indicate that soft skills enhance patient adherence, satisfaction, safety, trust, and shared decision-making. They also strengthen physicians' professional identity, confidence, collaboration, ethics, and resilience while reducing burnout. Additionally, soft skills improve system-level outcomes such as collaboration, resilience, safety, and public trust. Experiential, reflective, and competency-based pedagogies demonstrate the strongest impact, while AI-enhanced tools provide complementary value. Despite definitional ambiguity, fragmented curricular adoption, and limited longitudinal implementation, research highlights that key competencies—communication, emotional intelligence and empathy, professionalism, teamwork and collaboration, and critical thinking with reflective practice—operate as an interconnected and synergetic system. Reconceptualizing soft skills as an interconnected system, reinforced by cognitive, affective, humanistic, behavioral, and sociocultural mechanisms, advances theoretical clarity, supports programmatic assessment, and enables the integration of AI-related literacies, including data governance, algorithmic transparency, bias mitigation, and digital professionalism. Ultimately, excellence in medicine relies on harmonizing biomedical expertise and AI capabilities with humanistic and cognitive competencies to ensure that technological innovation strengthens, rather than undermines, the ethical and humanistic foundations of medical practice.

Keywords: medical education; soft skills; communication; empathy; emotional intelligence; professionalism; teamwork; critical thinking; reflective practice; artificial intelligence; narrative review

1. Introduction

Artificial intelligence (AI) is becoming increasingly embedded in healthcare, offering innovations in diagnostics, triage, and workflow optimization through risk-prediction models, decision support systems, and advanced analytics [1–4]. Yet, despite these advances, its broader impact remains uneven, constrained not only by methodological heterogeneity, algorithmic bias, and implementation barriers, but also by emerging regulatory and ethical challenges [5–7]. In medical education, AI-driven tools such as virtual patients, adaptive platforms, and simulations facilitate personalized and flexible learning. However, they also raise concerns about authenticity, professional identity formation, and the preservation of humanistic values [8–10]. Ensuring safe integration requires transparency, accountability, fairness, and trust calibration through explainability, as well as critical awareness of ethical and technical limitations [1,3,4,7,11]. Structural barriers, including faculty unpreparedness and curricular overload, further limit the systematic inclusion of AI literacy

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[8,10,12]. The EU's Artificial Intelligence Act reinforces the need for training in ethical reasoning, safety evaluation, transparency, human oversight, and risk management [7]. While scholars emphasize both opportunities and risks, a sustainable way forward requires embedding AI literacy, covering data governance, bias mitigation, explainability, and human oversight, into curricula, alongside communication and professionalism, to safeguard responsible and ethical practice [8–12].

Despite unprecedented technological progress, medicine continues to be defined by its humanistic core, trust, empathy, compassion, and ethical discernment, that elude automation and remain central to the physician–patient relationship [13–15]. Particularly in contexts of vulnerability and uncertainty, physicians must integrate patient narratives into shared decision-making, ensuring that AI complements rather than substitutes the therapeutic relationship [16]. Trust in AI must therefore be grounded in rigorous design, transparency, and ethical accountability, rather than in simulated empathy [17–20]. Without deliberate emphasis on humanistic practice, AI risks depersonalizing care and fueling skepticism about whether beneficence, compassion, and ethical integrity can be authentically sustained in technologically mediated healthcare [14,21]. While the importance of soft skills in medical education and their contribution to patient-centered care is widely recognized, existing literature remains fragmented by conceptual ambiguities, interchangeable terminology, and heterogeneous assessment methods [21,23–25]. Much of the existing research has examined competencies in isolation, overlooking their dynamic interactions as an interconnected system that shapes professional identity, ethical practice, and holistic patient-centered care. Moreover, limited attention has been paid to how the integration of AI reshapes the teaching, assessment, and application of these competencies. Addressing this lack of conceptual clarity, contextual integration, and mapping of interconnections defines the critical gap this review seeks to fill, offering both theoretical clarification and practical guidance for curriculum design, programmatic assessment, and faculty development in the AI era.

Therefore, the aim of this study is to examine the evolving role of soft skills in medical education in the AI era, conceptualizing them not as isolated attributes but as a synergistic and interdependent ecosystem of humanistic and cognitive competencies. Accordingly, the study addresses four research questions: (a) How are soft skills currently defined and integrated within the context of medical education, and what methodological ambiguities persist in their teaching and assessment? (b) How do AI-driven transformations in healthcare influence the role, relevance, and significance of soft skills? (c) Which pedagogical strategies are most effective in fostering these competencies, and what contextual and ethical considerations must be addressed when cultivating them within AI-enabled learning environments? (d) To what extent do core soft skills, such as communication, emotional intelligence, empathy, professionalism, teamwork, critical thinking, and reflective practice, operate as interconnected and mutually reinforcing competencies?

2. Materials and Methods

2.1. Search Strategy

A narrative literature review was conducted to synthesize peer-reviewed and grey literature on the role of soft skills in medical education. This method was selected for its ability to integrate heterogeneous sources into a comprehensive synthesis, enabling the identification of conceptual trends, pedagogical strategies, and evidence gaps. Particularly suited to domains characterized by diverse and wide-ranging bodies of research, narrative reviews provide a nuanced and contextually grounded analysis that captures the interplay of multiple factors while informing future directions in competency development [26,27]. The search was carried out between June and July 2025 across three databases: MEDLINE (via PubMed), Scopus, and Google Scholar. Search terms included variations of *"soft skills," "interpersonal skills," "non-technical skills," "non-technical competencies," "humanistic skills," "communication skills," "professionalism," "teamwork," "empathy," "emotional intelligence," "critical thinking," and "reflective practice," combined with "teaching," "training," "education," and "assessment."* The search was further refined to the context of *"medical education,"*

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"healthcare education," and "clinical education," and incorporated keywords reflecting either traditional or technologically enhanced approaches, such as "traditional," "conventional," "AI," "artificial intelligence," "AI-enhanced," "AI-based," and "machine learning." Boolean operators were adapted to each database to maximize retrieval. To broaden coverage, systematic snowballing of reference lists and manual searches of relevant journals were undertaken. Grey literature was also screened, focusing on reports and publications from professional and educational organizations active in medical education. This ensured inclusion of the most up-to-date and practice-oriented insights, thereby extending the evidence base beyond peer-reviewed sources.

2.2. Inclusion Criteria

Eligibility was limited to studies published from 2010 to 2025, capturing longitudinal trends in the teaching, assessment, and impact of soft skills. Given the volume of the literature, the review prioritized recent (2020-2025), systematic reviews and meta-analyses that synthesize findings across competencies, offering comprehensive perspectives on pedagogical approaches, assessment methods, and contextual challenges. Studies were included if they: a) were published in English, b) explicitly addressed the teaching, learning, or assessment of soft skills, c) focused on undergraduate, postgraduate, or continuing medical education) examined pedagogical approaches effective in the context of emerging AI technologies, providing recommendations for adapting soft skills training to AI-enabled medical education.

2.3. Data Extraction and Synthesis

Data extraction followed a structured and transparent process to ensure consistency and reproducibility. Informed by extensive engagement with the relevant literature and to enhance conceptual clarity, the competencies were grouped a priori into seven categories: (a) soft skills in general, (b) communication, (c) emotional intelligence and empathy, analyzed together to reflect models that position empathy as a central dimension of emotional intelligence, (d) professionalism, (e) teamwork and collaboration, and (f) critical thinking and reflective practice, examined jointly due to their inherent interconnection. In particular, reflection supplies the metacognitive monitoring and self-regulation that operationalize critical thinking, while critical thinking provides the analytical rigor that structures reflection. Together, they constitute a mutually reinforcing cycle that fosters adaptive expertise, lifelong learning, and problem-solving by enabling clinicians to identify biases, reassess assumptions, and generate context-sensitive solutions**.** Leadership, although frequently cited as a distinct competency, was not treated as a separate domain in this review. Its core elements—communication, collaboration, professionalism, and emotional intelligence—are extensively addressed within other competencies. Contemporary literature corroborates this integrative view, emphasizing that effective healthcare leadership is not a standalone skill but emerges from the interplay of adaptability, collaboration, self-awareness, and patient- or community-centered practice [28,29]. Consequently, leadership cannot be considered an independent competency but rather a composite outcome of interrelated soft skills.

After de-duplication, titles and abstracts were screened against predefined criteria, with full texts reviewed when eligibility was uncertain. A standardized template was used to capture study aims, context, competencies addressed, pedagogical strategies, assessment methods, and key findings. An inductive coding approach was then applied to identify recurring concepts, which were systematically grouped and synthesized into broader thematic categories. Finally, a narrative synthesis integrated findings across heterogeneous sources, mapped pedagogical strategies, and identified persisting evidence gaps, with particular attention to approaches relevant to the integration of soft skills in AI-enabled medical education.

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3. Results

A total of 134 studies were included in the analysis, with results presented in two sections. Section 1, clarifies the overarching concept and significance of soft skills in medical education and, critically, addresses the definitional ambiguity surrounding what counts as a soft skill in medicine. Section 2, analyzes six key competencies, communication, emotional intelligence and empathy, professionalism, teamwork, critical thinking, and reflective practice, by synthesizing recent evidence on their curricular integration, assessment strategies, and educational implications. Driven by ongoing conceptual and methodological uncertainties, this analysis clarifies the foundations of these competencies, outlines their impact on learners and patients, and positions them within current clinical contexts, including the challenges and opportunities presented by AI-enabled care.

3.1. Section 1: Soft Skills in Medical Education-From Conceptual Ambiguity to Foundational Competencies for Professional Identity and Humanistic Care

Soft skills, originating from broader educational and labor-economics discourses, are increasingly conceptualized as cross-disciplinary, metacognitive, social, and emotional capacities that extend beyond technical expertise. They encompass a wide range of competencies—including communication, teamwork, adaptability, problem solving, critical thinking, creativity, emotional intelligence, self-awareness, self-regulation, motivation, conflict management, leadership, intercultural competence, ethical responsibility, and resilience—that underpin employability, leadership, and system resilience in contemporary professional contexts [30–33]. Recent review also highlights the dual nature of soft skills as both interpersonal (e.g., communication, teamwork) and intrapersonal (e.g., self-regulation, motivation) capacities [31]. Within the academic literature, soft skills are positioned not only as essential complements to technical expertise but also as dynamic, evolving attributes required to address the demands of Industry 5.0, where adaptability, innovation, and human-centered capacities gain prominence [32,33].

In medicine, soft skills, often conceptualized as humanistic or non-technical competencies that complement biomedical expertise, are now widely recognized as integral to medical education. Their perceived novelty, however, is overstated: historically, from Hippocratic writings to 19th-century deontological texts, medicine has demanded the integration of technical expertise with relational capacities such as empathy, communication, and therapeutic alliance [34]. This historical continuity underscores that medicine has never been defined solely by scientific precision but equally by holistic engagement with patients. Despite this continuity, conceptual ambiguity, exacerbated by interchangeable labels such as soft skills, non-technical skills, professional competencies, and humanistic skills, continues to hinder integration and assessment [22,23,25]. Reviews highlight heterogeneous pedagogies, variable outcome measures, limited use of validated instruments, and only partial definitional consensus [22–25]. Evidence shows that structured non-technical skills training reduces errors, improves safety, supports adherence, and strengthens professional identity, while being directly linked to patient safety and quality improvement, however, evidence on sustained patient outcomes remains limited [24,25,35–37]. Emerging scholarship positions soft skills as central to professional identity and medicine's social contract, with curricula increasingly embedding socio-emotional and interpersonal competencies into structured, learner-centered training [22,34]. Recent review further suggests that the traditional technical–non-technical divide is largely artificial, reflecting weak construct clarity and reliance on non-validated self-reports [38].

Global competency frameworks have addressed the historical marginalization of soft skills by codifying them as core dimensions of clinical competence (Table 1). CanMEDS expands physicians' roles to include communication, collaboration, leadership, scholarship, advocacy, and professionalism [39,40], while the ACGME Milestones embed communication, professionalism, and reflection as longitudinal competencies shaping clinical identity [43,4142]. The AAMC Core EPAs similarly require communication, teamwork, professionalism, critical thinking, and reflection for safe transition to residency [44]. Interprofessional frameworks such as IPEC emphasize collaboration and

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communication, and the UK GMC Outcomes and Good Medical Practice integrate professionalism, leadership, and patient-centered communication [45–47]. The WHO framework organizes communication, teamwork, and leadership within people-centered domains to promote primary care and equity [48], and the WFME Global Standards mandate professionalism, communication, and collaboration as measurable outcomes for quality improvement in medical education [49]. Beyond frameworks, reform initiatives such as the Lancet Commission stress leadership, adaptability, and inter-professionalism as essential to resilient post-pandemic health systems [50,51].

Table 1. Comparative Overview of Global Competency Frameworks in Medical Education.

Framework / Organization	Core Domains / Competencies	Emphasis on Soft Skills
CanMEDS (39, 40)	Medical Expert, Communicator, Collaborator, Leader, Scholar, Health Advocate, Professional	Strong focus on communication, collaboration, professionalism, leadership, and advocacy; recent updates emphasize adaptability, digital health, and adaptive expertise.
ACGME Milestones Framework & Guidebooks (41–43)	Patient Care, Medical Knowledge, Interpersonal and Communication Skills, Professionalism, Practice-Based Learning & Improvement, Systems-Based Practice	Communication, professionalism, reflective practice, and systems-based collaboration function as longitudinal developmental dimensions shaping clinical competence and professional identity.
AAMC – Core Entrustable Professional Activities (EPAs) (44)	Core professional tasks that entering residents should be trusted to perform unsupervised (e.g., patient handover, history-taking, collaboration, systems navigation)	Embeds critical soft skills including communication, teamwork, professionalism, adaptability, and reflective practice in transition to residency.
IPEC – Core Competencies for Interprofessional Collaborative Practice (45)	Values/Ethics, Roles and Responsibilities, Interprofessional Communication, Teams and Teamwork	Explicit focus on interprofessional communication, collaboration, teamwork, and shared professional values across professions.
UK GMC – Outcomes for Graduates & Good Medical Practice (46, 47)	Clinical Practice, Professionalism, Leadership, Patient-Centered Care	Embeds professionalism, leadership, and patient-centered communication as expected graduate outcomes and regulatory standards.
WHO – Global Competency and Outcomes Framework for UHC (48)	People-Centered Competencies; Service Competencies; System Competencies	Communication, teamwork, leadership, cultural competence, and equity identified as essential to strengthening primary health care and advancing universal health coverage.
WFME – Global Standards for Basic Medical Education (49)	Mission & Values, Curriculum, Assessment, Students, Staff, Resources, Quality Assurance, Governance	Defines communication, collaboration, and professionalism as measurable learning outcomes and quality benchmarks for accreditation and continuous improvement.

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3.2. Section 2: Analyzing Soft Skills in Medical Education

3.2.1. Communication Skills

Effective communication constitutes a cornerstone of medical practice, fostering trust, accurate information exchange, and therapeutic relationships that extend beyond routine encounters to complex situations such as breaking bad news, conflict management, and culturally sensitive care. Robust evidence from systematic reviews links strong communication skills to improved adherence, patient satisfaction, and clinical outcomes, while communication failures are consistently associated with adverse events and delays [52–56]. In medical education, communication is recognized as a teachable and assessable competency that requires early introduction and longitudinal reinforcement, with interventions demonstrating measurable improvements in OSCE performance, shared decision-making, and relationship-building when supported by clinical contextualization, role modeling, and supportive institutional culture. Pedagogical strategies including role-play, high-fidelity simulation, and informed-consent training have shown effectiveness [56–63], while emerging AI-enabled methods, such as virtual humans, synthetic patients, and automated feedback, offer realistic, low-risk opportunities for practice, though current evidence remains preliminary [64–67]. Complementary reinforcement approaches, including structured handoffs, interprofessional communication, and Teach-Back techniques, further enhance clarity, empathy, and collaborative safety, ultimately improving patient experience and healthcare outcomes [61,68,69].

Artificial intelligence is reshaping the dynamics of clinical communication by reducing cognitive load, aiding synthesis, and freeing clinicians' time for empathic interaction, while also offering personalized learning opportunities for trainees [65–67]. Yet, if introduced without critical reflection, AI may contribute to depersonalization, resistance among clinicians, and diminished patient trust. Evidence indicates that patients frequently prefer human judgment over algorithmic advice, underscoring the importance of transparency in presenting AI-generated recommendations, acknowledgment of uncertainty and bias, and careful integration into shared decision-making to preserve autonomy [,70]. Accordingly, communication training in medical curricula must move beyond technical literacy to incorporate competencies in transparent explanation of AI outputs, calibration of trust between human and machine judgment, and ethical reasoning about bias and uncertainty, ensuring that algorithmic insights complement rather than replace humanistic care [21,65,70].

3.2.2. Emotional Intelligence and Empathy

Emotional intelligence (EI), defined as the ability to perceive, understand, and regulate emotions, with empathy often considered a central component alongside self-awareness and interpersonal skills. Evidence consistently affirms that EI, is associated with enhanced clinical performance, teamwork, resilience, and reduced burnout, although its contribution to academic success is limited, suggesting that EI contributes more meaningfully to relational and professional domains than to cognitive achievement [71–74]. Despite methodological variability and scarce longitudinal data [74], systematic reviews and meta-analyses demonstrate that EI can be effectively cultivated through reflective practice, mindfulness, experiential learning, and simulation, supporting leadership, conflict management, and cultural sensitivity [74–77]. Empathy, a cornerstone of professionalism, shows a consistent decline during medical training, as confirmed by multi-institutional studies and systematic reviews [78–80]. At the same time, evidence demonstrates that empathy is teachable and responsive to structured, longitudinal interventions such as narrative medicine, reflective writing, and arts-based methods [81–83]. Randomized trials report moderate, sustained improvements influenced by gender, specialty, and cultural context [84,85], with cognitive empathy linked to well-being and patient-centered communication, while affective empathy shows weaker or inconsistent protective effects [86,87]. Nevertheless, the heterogeneity of empathy training and uncertainty over long-term effectiveness highlight the need for standardized, programmatic approaches [81–84,86–88].

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In the context of artificial intelligence (AI), the literature emphasizes that emotional intelligence and empathy remain irreplaceable for preserving the relational and ethical dimensions of medical care. Medical students themselves express ambivalence—acknowledging AI's utility while fearing its detrimental impact on empathy and other humanistic skills [89]. Although AI can improve efficiency and predictive accuracy, it cannot reproduce the social context, embodied intersubjectivity, and emotional depth that underpin authentic therapeutic relationships [14,90–92]. Physicians are therefore required to translate algorithmic outputs into compassionate, trust-building conversations that protect autonomy and enable shared decision-making [909]. Reviews further warn that uncritical reliance on AI risks depersonalization and erosion of trust, particularly when compassion is simulated rather than authentically experienced [14,15]. Both philosophical analyses and empirical findings converge on the conclusion that empathy, as an embodied and intersubjective capacity, cannot be replicated computationally [14,91,92]. Evidence from AI-assisted therapy similarly indicates that while such tools may expand access to care, their effectiveness ultimately depends on the presence of genuine human empathy to sustain authenticity and trust [92]. Consequently, empathy and EI must be prioritized as core learning objectives in AI-enabled education, cultivated through reflective and relational pedagogies that complement technological training.

3.2.3. Professionalism

Professionalism in medicine encompasses the values that sustain the profession's social contract, including altruism, integrity, accountability, respect, and ethical practice [93–95]. Beyond a skill set, it constitutes a moral obligation that legitimizes medicine's authority and shape's professional identity [96–98]. Longitudinal evidence shows that lapses in reliability or feedback acceptance predict later disciplinary action, underscoring the value of early remediation [99,100] while systematic review categorize unprofessional behaviors to guide early detection and intervention [101]. Systematic reviews consistently portray professionalism as a multidimensional yet contested construct, characterized by definitional ambiguity, heterogeneous standards, and cultural variability [95,102–104]. Medical curricula foster professionalism through longitudinal integration into training, with evidence highlighting role modeling, reflective practice, peer-assisted learning, and structured feedback as the most effective strategies for developing professional identity and remediating lapses [105–110,112]. At the postgraduate level, professionalism extends to ethical decision-making and conflict-of-interest management, but systematic reviews highlight that heterogeneous assessment methods limit comparability across programs [102]. Competency frameworks such as CanMEDS and the ACGME milestones explicitly integrate professionalism with leadership, resilience, and emotional intelligence, reinforcing its central role in medical education and professional identity formation [114].

The rise of digital health and artificial intelligence (AI) amplifies the ethical dimensions of professionalism, necessitating attention to transparency, accountability, bias, privacy, and depersonalization [115]. E-professionalism and online identity extend professionalism into the digital sphere, where confidentiality, reputational risk, and digital conduct are critical, yet also present new opportunities for advocacy, education, and interprofessional collaboration [116,117]. To prepare future physicians for these challenges, curricula must go beyond traditional professionalism frameworks by embedding AI and data literacy, with explicit attention to model limitations, bias, explainability, and governance. Equally important are reflective and ethical practices that help learners evaluate when and how to rely on algorithmic outputs and to manage conflicts of interest. Addressing reputational risk also requires explicit communication training, including guidance on professional digital interactions, managing online patient queries, and responding to misinformation. Such integration strengthens medicine's social contract while cultivating adaptive, ethically grounded professional identities for an AI-driven era.

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3.2.4. Teamwork and Interprofessional Collaboration

Teamwork in healthcare is increasingly conceptualized as collective competence—a distributed capability emerging from team interactions and contextual dynamics rather than the aggregation of individual skills [118]. Empirical and theoretical syntheses confirm that effective teamwork, grounded in structured communication, trust, and role clarity, enhances patient safety, care quality, staff well-being, and organizational resilience [119,120]. In medical education, interprofessional and simulation-based learning have proven particularly effective in strengthening collaboration, communication, and adaptability across undergraduate and postgraduate levels [121–123]. Systematic reviews highlight interventions such as crisis resource management, structured communication protocols, and organizational redesign as drivers of team effectiveness [124], while operating room studies demonstrate the value of briefings, debriefings, and checklists in reducing errors and fostering shared mental models [125]. Globally, meta-analytic evidence shows that task-sharing and task-shifting strategies are especially impactful in resource-limited settings, improving outcomes and reducing mortality among multimorbid patients [126]. Finally, team situation awareness is increasingly recognized as a hallmark of high-performing teams and a determinant of patient safety, reinforced through simulation, interprofessional training, and crisis management education [127].

AI-enabled systems are reshaping task allocation, coordination, and clinical decision-making, requiring clinicians to acquire competencies in interprofessional dialogue and calibrated reliance on algorithmic recommendations [128]. Insights from team science indicate that human–machine teams demand novel capabilities, including trust calibration, shared situation awareness, and adaptive communication, emphasizing that teamwork in AI-mediated contexts is both clinical and epistemic, as collective judgment and transparent dialogue remain vital safeguards against overreliance and misinterpretation [129]. Consensus reports further stress the importance of interdisciplinary collaboration—engaging clinicians, data scientists, ethicists, and legal experts—to critically appraise AI outputs and mitigate risks related to bias and opacity [130]. For medical education, these shifts necessitate curricula that integrate explicit training in human–machine teaming, including simulation-based exercises where learners practice explaining AI outputs to colleagues and patients, structured activities to strengthen trust calibration and uncertainty management, and interdisciplinary modules that cultivate collaboration across clinical, technical, and ethical domains.

3.2.5. Critical Thinking and Reflective Practice

Critical thinking (CT) in medicine refers to the capacity to analyze information, evaluate evidence, and make sound judgments under uncertainty, forming the basis of clinical reasoning and problem-solving [131–134]. Reflective practice (RP) extends this capacity through metacognitive monitoring, bias recognition, and self-regulation, supporting problem-solving, adaptive expertise, and professional identity formation [135–139]. Together, CT and RP reduce diagnostic errors and improve accuracy [139,140], yet their curricular integration remains inconsistent due to overload, assessment misalignment, and limited faculty preparation [141,142]. Evidence from systematic reviews shows that learner-centered methods—particularly problem-based learning, concept mapping, and reflective writing—enhance reasoning and metacognition, with longitudinal approaches yielding the strongest effects [131,132,136,143–145]. The development of CT is also culturally shaped, with Western traditions privileging Socratic questioning, debate, and challenge, while collectivist contexts emphasize consensus and introspection, underscoring the need for culturally responsive strategies [146–149]. In postgraduate training, CT focuses on decision-making under uncertainty, bias recognition, and adaptability, supported by case reviews, journal clubs, simulation, and interprofessional learning, with digital and simulation-based methods further consolidating CT and RP as longitudinal professional competencies [132,133,139,150].

The integration of artificial intelligence (AI) and digital health technologies underscores the need to embed CT and digital literacy as core competencies in medical curricula. While digital tools can generate high-quality data and support clinical decision-making [151], their reliability is constrained

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by algorithmic opacity, bias, and ethical ambiguity [155]. To address these challenges, educational strategies increasingly focus on cultivating learners' ability to critically interrogate AI outputs, with evidence showing that involving students in the co-design of AI-enabled clinical decision support systems enhances digital-health CT and interpretive judgment [153]. Effective integration also requires alignment with ethical awareness, governance principles, and humanistic values to ensure that technical proficiency is balanced with professional accountability [154]. The rapid emergence of generative AI, such as ChatGPT, further amplifies opportunities for adaptive learning while heightening the need for reflective judgment and safeguards against overreliance [155].

3.2.6. Impact on Patient and Physician Outcomes – Synergistic Interconnections among Competencies

Table 2 maps each competency to its definitions, outcomes, learning objectives, and pedagogical strategies, showing how traditional and AI-enhanced approaches jointly strengthen humanistic and cognitive capacities while safeguarding ethical practice. Communication, emotional intelligence and empathy, professionalism, teamwork, and critical thinking with reflective practice generate outcomes at multiple levels: improved adherence, satisfaction, shared decision-making, autonomy, safety, and trust for patients [53–55,69]; enhanced professional identity, confidence/competence, collaboration, and resilience for trainees and physicians—with lower burnout associated with higher empathy—[59,87,108,114]; and stronger interprofessional collaboration, organizational resilience, and public trust at the system level [119,120,124,125]. Evidence supports learner-centered, experiential, reflective, and competency-based pedagogies for developing these competencies [56,131,136,143,144,149]. In addition, AI-enabled methods can add value by fostering transparency, trust calibration, bias recognition, and reflective judgment [64–66,130,153].

Table 2. Methods and Learning Outcomes for Core Soft Skills Competencies in Medical Education and the AI Era.

Competency	Patient/Doctor Outcomes	Key Learning Outcomes (General)	Key Learning Outcomes in the AI Era	Teaching Methods
Communication	Improves adherence, satisfaction, and trust; reduces adverse events; strengthens shared decision-making and safer handovers [52–56].	Build rapport and trust; take accurate histories; provide clear explanations; handle difficult conversations (e.g., breaking bad news); manage cultural differences and conflict; ensure effective interprofessional handoffs [56,60–63,69]. Supports inter-professional collaboration and improves team performance [119,120,125].	Explain AI-generated recommendations transparently; communicate uncertainty, bias, and limitations; calibrate human–machine trust; integrate probabilistic outputs into shared decision-making [64–67,70,89].	Traditional: role-play, OSCEs, simulations, mentorship [56,60–63]. AI-enhanced: virtual patients, synthetic avatars, automated feedback, generative-AI conversation scenarios [64–67].
Emotional Intelligence (EI) & Empathy	Strengthens therapeutic alliance, improves patient	Develop self-awareness and emotion regulation; recognize and respond to patient emotions; build therapeutic alliances;	Translate AI insights into compassionate, trust-building communication;	Traditional: reflective writing, narrative medicine, mindfulness, arts-based methods, peer groups [81–84].

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	satisfaction and resilience; associated with reduced burnout; supports patient-centered communication [54,55,71,72,87].	enhance cultural sensitivity; manage conflict [75–77,81–84].	safeguard autonomy and human connection; recognize limits of "empathic AI"; avoid depersonalization [14,89,91,92].	AI-enhanced: VR empathy simulations, AI-driven reflective prompts, affective-computing tools [89,92].
Professionalism	Enhances patient safety, collaboration, and public trust; lapses predict later disciplinary action [99–101].	Internalize codes of conduct; demonstrate integrity, accountability, and respect; navigate ethical dilemmas and conflicts of interest; develop professional identity via reflection, feedback, and remediation [93,95,96,98,106,108,109,111].	Practice e-professionalism and digital identity management; communicate AI outputs ethically; apply principles of bias mitigation, fairness, transparency, and governance in AI use; reflect on algorithmic reliance [115–117].	Traditional: role-modelling/mentorship, codes-of-conduct workshops, reflective writing, professionalism simulations [93,104–106,108]. AI-enhanced: AI-integrated ethics cases, e-professionalism modules, AI-augmented OSCE scenarios [115,117].
Teamwork & Interprofessional Collaboration	Improves safety and quality, reduces errors and mortality, strengthens organizational resilience and role clarity [119,120,124–126].	Demonstrate role clarity, mutual respect, and psychological safety; use structured communication tools; practice crisis resource management; build shared mental models and situational awareness [118,121,122,124,125,127].	Develop human–machine teaming skills; calibrate trust in AI outputs; maintain shared situational awareness in AI-mediated care; collaborate with data scientists/ethicists; share accountability for AI-supported decisions [127–130].	Traditional: interprofessional simulations, CRM, briefings/debriefings, checklists [121,123–125]. AI-enhanced: AI-integrated team simulations, negotiation of AI–human disagreements, team dashboards, CDSS-in-the-loop [127–130].
Critical Thinking (CT) & Reflective Practice (RP)	Reduces diagnostic error; improves reasoning, adaptability,	Identify assumptions; integrate diverse information; recognize and correct cognitive biases; develop adaptive	Critically appraise AI recommendations; detect and address	Traditional: PBL, concept mapping, reflective writing/portfolios, journal clubs, argument mapping [131,136,140,143,144,146,1

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	and bias recognition [132,133,139,142].	expertise; practice lifelong learning; analyze complex cases; engage in systematic reflection [131,133,136,137,140,141,143–146,149].	algorithmic bias; integrate probabilistic outputs with patient values; maintain reflective judgement in digital environments; co-design and evaluate AI-CDSS [151–155].	49]. AI-enhanced: AI-based decision-support simulations, digital reflective portfolios, AI-integrated case studies and co-design tasks [151–154].

Table 3 extends the analysis by mapping how competencies interconnect through cognitive, affective, humanistic, and behavioral mechanisms, while also identifying typical failure modes. It demonstrates that soft skills function as an interdependent and synergistic system, sustained by shared mechanisms such as trust-building, ethical grounding, bias recognition, and reflective learning [120,136,139,142].

Table 3. Competencies, Connection Mechanisms, and Typical Failure Modes.

Competency	Connection Mechanisms	Typical Failure Modes	Cross-links to Other Competencies
Communication	Cognitive: clarity, structured reasoning [52,56] Affective: empathy, trust calibration [53,55] Humanistic: autonomy, transparency [54,69] Behavioral: active listening, conflict management, safe handovers, reputation protection [60,61,63,68]	Overuse of jargon; neglect of emotional cues; mechanical delivery of AI outputs; detachment; unsafe handovers; escalation of complaints [56,69].	↔ Empathy/EI (missed emotions) ↔ Teamwork (miscommunication, poor coordination) ↔ Professionalism (complaints, reputational damage) ↔ Reflective practice (missed feedback loops)
Emotional Intelligence (EI) & Empathy	Cognitive: appraisal of emotions, bias recognition [71,72] Affective: compassion, resilience [75,77] Humanistic: dignity, patient autonomy [87] Behavioral: regulation, empathic communication, conflict resolution [81,82,85]	Emotional leakage; depersonalization; unmanaged burnout; overreliance on "empathic AI" [79,80,92].	↔ Communication (tone, non-verbal mismatch) ↔ Teamwork (conflict escalation) ↔ Professionalism (perceived disrespect) ↔ Reflective practice (defensive/non-learning stance)
Professionalism	Cognitive: ethical reasoning, judgment [94,95] Affective: integrity, accountability [93,109] Humanistic: social contract, trust [108] Behavioral: role-modelling, transparency, digital conduct [100,115,117]	Ethical breaches; unprofessional digital behavior; lack of accountability; trust erosion; malpractice or disciplinary action [100,116].	↔ Communication (credibility, trust loss) ↔ Empathy (seen as insincere) ↔ Teamwork (blame-shifting) ↔ Reflective practice

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			(failure to learn from lapses)
Teamwork & Interprofessional Collaboration	Cognitive: shared situation awareness, collaborative problem-solving [119,120] Affective: trust, respect [118] Humanistic: inclusivity, responsibility [127] Behavioral: structured communication, role clarity, adaptability [124,129,130]	Communication breakdowns; role ambiguity; trust erosion; conflict escalation; siloed decision-making; unsafe AI reliance [124,127,130].	↔ Communication (handoff failures) ↔ Empathy (poor regulation under pressure) ↔ Professionalism (accountability gaps) ↔ Critical thinking (groupthink, lack of challenge)
Critical Thinking & Reflective Practice (RP)	Cognitive: reasoning, metacognition, bias recognition [131,133] Affective: openness, humility [149] Humanistic: ethical orientation, patient values [135,137] Behavioral: reflection, adaptive decision-making, error recognition [132,143,144]	Unchecked cognitive biases; premature closure; uncritical AI reliance; failure to detect algorithmic bias; superficial reflection [139,142,151,153–155].	↔ Communication (mis framed information) ↔ Teamwork (poor shared judgment) ↔ Professionalism (flawed ethical choices) ↔ Empathy (ignoring patient perspective)

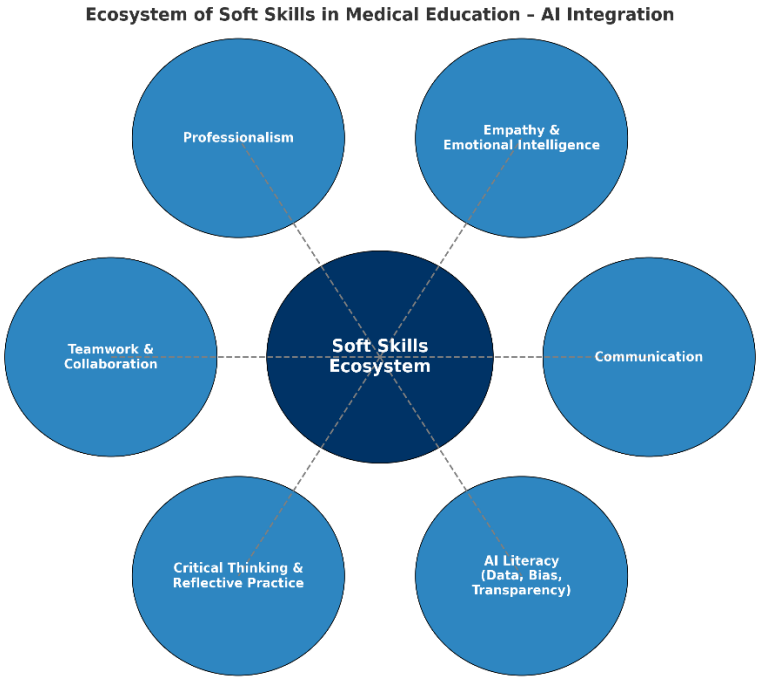

Figure 1. Conceptual ecosystem of soft skills in medical education and AI integration.

4. Discussion

This review underscores that soft skills are indispensable in medical education in the AI era. Evidence consistently demonstrates that communication, empathy, professionalism, teamwork, critical thinking, and reflective practice yield measurable benefits for patients, physicians, and health systems. To date, no review has systematically mapped the interrelated domains of core soft skills in

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medical education while simultaneously examining their transformation under the challenges and opportunities of AI integration. Whereas previous reviews addressed discrete competencies, broadly surveyed soft or non-technical skills [22–25,38], or focused exclusively on AI in medical education [8–12], this synthesis conceptualizes soft skills as a synergistic, interdependent ecosystem explicitly integrated with AI. By situating soft skills within this dual framework—humanistic foundations and AI-enabled transformations—this study provides conceptual clarification, highlights pedagogical implications, and establishes a foundation for future empirical validation. Collectively, the findings emphasize the need for integrated curricula that embed soft skills as core competencies, aligning humanistic, cognitive, and system-level capacities to advance ethical, patient-centered, and resilient healthcare in the AI era.

4.1. The Ambiguity of "Soft Skills" in Medical Education

Definitional ambiguity continues to fragment the field, as interchangeable labels hinder consistent teaching and assessment, particularly in AI-enabled contexts. The hidden curriculum, shaped by tacit norms and hierarchies, often privileges biomedical expertise over relational and humanistic capacities, undermining empathy, adaptability, and professionalism. Relationship-centered and transformative pedagogies, emphasizing reflection, resilience, compassion, and cultural sensitivity, are essential in addressing these gaps [156–161]. Soft skills, broadly understood as interpersonal, intrapersonal socio-emotional, and metacognitive capacities, foster adaptability, collaboration, and resilience [30,31,33,36,37]. By contrast, non-technical skills are more narrowly tied to operational safety behaviors, and professional competencies codified in global frameworks serve mainly as regulatory benchmarks [39,44–48]. Humanistic skills highlight empathy, compassion, and cultural sensitivity [34] but do not encompass the full range of competencies required in modern healthcare. Against this background, soft skills, if clearly defined and systematically mapped to global frameworks, emerge as the most comprehensive umbrella construct, integrating cognitive, affective, humanistic, and behavioral dimensions and offering a coherent foundation for programmatic assessment. Establishing a consensus definition and systematic mapping to competency frameworks would provide theoretical clarity and practical tools for programmatic assessment, better preparing physicians to navigate technologically mediated and information-saturated healthcare environments

4.2. The Interconnected Ecosystem of Soft Skills Competencies

Soft skills function as an interdependent ecosystem of cognitive, affective, humanistic, and behavioral capacities. Cognitive abilities such as diagnostic reasoning and critical judgment support decision-making under uncertainty and interpretation of AI outputs, while affective capacities—including empathy, resilience, and emotion regulation—preserve trust and human connection. Humanistic values such as dignity, respect, and cultural humility safeguard against depersonalization, and behavioral capacities like transparent communication, teamwork, and accountability gain new significance in AI-enabled contexts through disclosure, collaboration, and digital professionalism. These domains are reinforced by shared mechanisms—trust-building, bias recognition, and reflective learning—that provide ethical grounding and adaptive judgment. Failures in communication, empathy, professionalism, or teamwork can trigger cascading breakdowns, undermining safety, trust, and system performance.

An illustrative example highlights their multidimensional impact across levels. For patients, communication, empathy, professionalism, improve adherence, satisfaction, shared decision-making, autonomy, and trust, while teamwork and critical thinking reduce errors, lower mortality, and strengthen organizational resilience [52,55,69,84,120,124,127]. For students and physicians, these competencies enhance OSCE performance, metacognition, and professional identity formation, while mitigating burnout and fostering resilience, conflict resolution, leadership, and collaboration [56,59,61,75,84,87,157]. At the system level, they promote interprofessional collaboration, reinforce accountability, reduce malpractice risks, and sustain public trust. By emphasizing overlapping

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domains, soft skills enhance efficiency through integrated teaching, support curricular mapping and programmatic assessment, and reinforce professional identity formation, while simultaneously opening space for AI-related literacies such as data governance, algorithmic transparency, and digital professionalism [3,19,21,151]. Future research should develop multi-level models to clarify causal pathways, identify situational moderators, and establish measurable links to patient outcomes [142].

4.3. Educational Implications for Integrating Soft Skills into Medical Education

Evidence consistently identifies experiential, reflective, and competency-based pedagogies as the most effective strategies for cultivating soft skills, with AI-enhanced tools—such as virtual patients, adaptive simulations, and automated feedback—providing complementary value when integrated thoughtfully [56,61,62,84,95,109,124,136,137]. Embedding AI literacy, covering transparency, bias recognition, digital professionalism, and human–machine collaboration, alongside core competencies is essential to ensure that innovation reinforces, rather than erodes, the humanistic foundations of medicine [21,70,115–117,129,150,153]. Implementation, however, remains uneven across curricula due to faculty unpreparedness, curricular overload, and limited validated assessment instruments. Addressing these barriers requires structured faculty development, integrated curriculum mapping, and programmatic assessment approaches that span undergraduate, postgraduate, and continuing education. Equally important is cultural adaptation. Communication styles, empathy, teamwork dynamics, and professionalism vary across socio-cultural settings, underscoring the need for locally responsive pedagogies that avoid ethnocentric assumptions while also mitigating algorithmic and linguistic biases in AI-enabled education [80,87,118,146–148].

4.4. Limitations and Implications for Future Research

The narrative review methodology adopted in this study, while appropriate for synthesizing themes and integrating diverse theoretical perspectives, lacks the systematic rigor of meta-analyses and systematic reviews, thereby limiting the comprehensiveness and generalizability of its conclusions. Reliance on a limited set of databases, English-language publications, and a defined timeframe introduces risks of selection and publication bias, while evidence on AI-specific interventions remains emergent, heterogeneous, and often characterized by short follow-up periods and surrogate outcomes.

Nonetheless, it is among the first comprehensive syntheses to examine the full spectrum of soft skills while explicitly integrating AI literacies. The proposed framework complements, rather than replaces, established frameworks (e.g., ACGME, CanMEDS, WHO), adding value by reconceptualizing soft skills as interconnected and mutually reinforcing. Moreover, it offers both conceptual and pedagogical value by clarifying the relational nature of soft skills and providing a foundation for systematic testing and empirical validation. Future priorities include: (i) achieving consensus definitions and clearer scope delineation, (ii) developing validated assessment tools linked to patient, learner, and system outcomes, (iii) conducting longitudinal and cross-cultural research on mechanisms of interaction, (iv) implementing structured faculty development for effective role modeling, and (v) designing integrated curricula that align soft skills with AI literacy to cultivate adaptive, ethical, and resilient physicians capable of sustaining humanistic practice in technologically mediated healthcare.

5. Conclusions

This review demonstrates that soft skills are fundamental to medical education, professional identity formation, and patient-centered care. Despite persistent conceptual ambiguities and heterogeneous pedagogies, evidence shows that communication, empathy, professionalism, teamwork, critical thinking, and reflective practice enhance safety, trust, and resilience. Experiential, reflective, and competency-based methods— which emphasize clearly defined learning outcomes and assess learners on the demonstration of specific skills, behaviors, and attitudes rather than on

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time spent in training—are consistently the most effective, with AI-enhanced tools adding value when integrated. The proposed framework reconceptualizes soft skills as an interconnected ecosystem embedding algorithmic literacy and digital professionalism within broader humanistic and cognitive capacities, offering clarity and utility for curriculum mapping, assessment, and identity formation. Although challenges in construct clarity, standardized evaluation, and longitudinal implementation remain, the model provides a scaffold for research and sustainable integration. Future progress requires consensus-driven definitions, validated outcome-linked assessments, and culturally responsive pedagogies that align humanistic competencies with the ethical integration of AI, ensuring that technological innovation strengthens rather than undermines the relational and ethical foundations of medicine.

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Abbreviations

The following abbreviations are used in this manuscript:

ACGME	Accreditation Council for Graduate Medical Education
AAMC	Association of American Medical Colleges
AI	Artificial Intelligence
CanMEDS	Canadian Medical Education Directives for Specialists
CDSS	Clinical Decision Support System
CT	Critical Thinking
EI	Emotional Intelligence
EPA	Entrustable Professional Activity
GMC	General Medical Council
IPEC	Interprofessional Education Collaborative
OSCE	Objective Structured Clinical Examination
PBL	Problem-Based Learning
RP	Reflective Practice
TSA	Team Situation Awareness
UHC	Universal Health Coverage
WHO	World Health Organization
WFME	World Federation for Medical Education

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