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Healthcare Professional's Lifelong Learning Automation by Adapting Pedagogical Currents and Bloom's Taxonomy to Artificial Intelligence

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ABSTRACT

This study focuses on the integration of artificial intelligence (AI), pedagogical techniques and Bloom's taxonomy in health sciences education. AI plays a key role in this field, changing educational paradigms through personalized learning experiences. Methodology: The study examines how AI enables personalized educational progression based on individual needs, promoting continuous lifelong learning. It examines the potential of AI to provide rapid feedback on tasks and assessments, improving conceptual understanding. In addition, AI helps trainers discover learning trends through data analysis, and creates dynamic learning environments. Results: Research shows that AI-based education systems boost students' grasp of complicated subjects, problem-solving ability, and writing capabilities. Furthermore, AI's flexible capabilities enhance educational inclusion by tailoring learning approaches to various individual problems. Discussion: The findings highlight AI's transformative impact on health sciences education, stressing the transition from traditional models to adaptive, learner-centered approaches. AI's ability to accommodate different learning styles and facilitate continual skill development demonstrates its promise to transform professional education in the health sciences. Conclusion: Integrating AI into health sciences education not only improves learning outcomes but also fosters a culture of lifelong learning among students and practitioners. As AI advances, its integration with pedagogical frameworks such as Bloom's taxonomy opens up new possibilities for improving educational procedures and preparing future healthcare practitioners for dynamic professional challenges.

Keywords: ***Health sciences, Artificial intelligence, Automation, Lifelong Learning, BLOOM taxonomy***

I. INTRODUCTION

The intersection of artificial intelligence (AI) with education has enabled transformative advancements in personalizing learning experiences, particularly in the rapidly evolving field of health sciences education. AI-powered educational tools are gradually making lifelong learning, a basic concept stressing ongoing skill development and information acquisition throughout one's professional career, more accessible. In recent years, AI has emerged as a strong ally, offering personalized educational pathways that suit individual learners' specific needs throughout their careers. This paradigm shift goes beyond traditional educational models, ushering in a new era in which students in health sciences disciplines can advance at their own pace while receiving targeted support tailored to their specific needs, promoting lifelong learning practices in the healthcare workforce. In this context, AI technology not only adapts content to learners' various learning styles, but it also customizes teaching approaches, assigning additional assignments to strengthen weak regions and providing precise support when needed. This individualized approach not only changes the landscape of healthcare education, but it also underlines the importance of lifelong learning in keeping healthcare workers up to date and competent in their field. We look at AI's adaptability to meet rising learning demands, its revolutionary impact on present pedagogical frameworks, and the challenges and opportunities that lie ahead as we delve into the complex

interplay between AI and health sciences education. Furthermore, we investigate how artificial intelligence interacts with various educational theories to improve collaboration, adaptation, and individualization in health sciences learning environments, thereby expanding the concept of lifelong learning in the health sciences profession. Artificial intelligence (AI), as the most current educational facilitator, has enormous potential for personalizing the learning experience. It functions as a common virtual instructor, responding to each learner's unique needs and providing individualized education paths. Similarly, new personalized learning approaches aim to adapt instruction to various learning styles. AI, positioned as the new digital educator, represents a significant transformation in educational processes, stressing personalisation and adaptation in the educational environment [1]. Additionally, it provides instant feedback on activities and assessments, which improves conceptual comprehension. AI provides instruction and support via chatbots and virtual assistants, resulting in an environment that encourages learning beyond traditional classroom hours. Its expertise in data analysis helps educators spot trends and improve instructional practices. AI enables interactive communication by leveraging language processing capabilities, while gamification components add excitement to the learning process. AI emerges as a disruptive force in education, emphasizing personalization, adaptation, and efficiency by reducing administrative duties, promoting remote learning, and constantly adapting to changing demands [2]. An investigation was conducted to determine the effectiveness of an AI-powered teaching system in improving students' understanding of difficult mathematical subjects. Researchers discovered that students who received individualized coaching using the AI platform demonstrated considerably improved comprehension and problem-solving ability compared to those who only received traditional training [3]. Furthermore, another study investigated the effects of AI-driven feedback mechanisms on students' writing abilities. Their findings showed that students who received feedback from an AI-based writing aid improved their writing skill and confidence levels over time, highlighting AI's positive impact on student learning experiences [4]. Furthermore, qualitative investigations have explored how students view and feel about AI in the classroom. Interviews with high school students revealed a general sense of interest and enthusiasm about the use of AI tools in the classroom. Students conveyed gratitude for the individualized support and timely feedback AI systems provide, which enhanced the atmosphere of learning and encouraged learner participation [5]. The incorporation of artificial intelligence (AI) into health science education marks a significant step forward, providing individualized learning experiences tailored to individual participant needs. AI's distinctive strength resides in its ability to assimilate complex data on students' learning styles, preferences, and comprehension levels in the field of health sciences [6]. This individualized approach goes beyond traditional techniques, allowing health sciences students to work through course material at their own pace while meeting their specific learning needs. Beyond content adaptation, AI promotes adaptability in instructional methodologies, gives additional activities to reinforce knowledge, and provides tailored support as needed [7]. One significant application of AI in health sciences education is its capacity to identify conceptual gaps in students' comprehension and provide suitable exercises to help them improve their skills. For example, AI might provide difficult clinical settings to encourage advanced students' critical thinking. This ongoing adaptability reflects the intrinsic variety in health science education, where learning paths are frequently nonlinear [8]. AI's adaptability in health sciences education efficiently addresses students' different learning methods and individual progress across fields such as medicine, nursing, and pharmacy. Whether students prefer self-directed learning or require more organized education, AI acts as a digital teaching tool that adapts to these differences, establishing a delicate balance between autonomy and support. In the educational context of the health sciences, AI recognizes the specific needs of learners and adapts courses to facilitate the learning task. This can include case studies personalized to learners' level of understanding, demonstrating the importance of adaptation in the health sciences learning process [9]. As we progress further towards a more personalized approach to education, it is becoming clear that this ability to adapt is not only crucial for academic environments, but also for fostering a culture of continuous self-improvement.

II. METHODOLOGY

Lifelong learning is founded on the notion that everyone, regardless of age or occupation, has the ability to learn throughout their lifetime [8]. Self-directed education promotes lifelong learning [8]. Thus, in the age of artificial intelligence, learning should shift from human capital to human enhancement, with a focus on human skills [10]. Technology is increasingly being used to imitate human behavior in order to help people learn and work. Continuous professional development is an important part of lifetime learning for healthcare practitioners [11]. Lifelong learning is both an opportunity and an obligation in the health care activity. It enables professionals to offer patients the safest and most effective care available. This lowers costs while simultaneously improving patient outcomes, both of which are continuous aims in healthcare [12].

This study targeted Moroccan healthcare professionals using a snowball sampling strategy, a non-probability method that allows participants to be recruited through their professional networks. A group of 95 professionals was chosen based on specific inclusion and exclusion criteria: participants had to be Moroccan health professionals with at least one year of experience, while students in training, retirees, and those working abroad were excluded. Data were collected using a 53-item questionnaire based on John R. Kirby's model. Before its wide administration, the questionnaire was validated by a pre-test with ten participants similar to the study population,

which enabled the questions to be refined for clarity and relevance. The questionnaire was then submitted to a scientific committee made up of experts in research methodology and health sciences. This committee examined and validated the questionnaire's content, ensuring its relevance and ability to gather the necessary information. Cronbach's alpha was calculated to examine the questionnaire's internal reliability, which is a measure of item response consistency. In this investigation, the Cronbach's alpha coefficient was 0.82, indicating that the scales were reliable. A Cronbach's alpha of 0.70 or more is generally deemed acceptable, and a value of 0.82 indicates strong internal consistency, reaffirming the reliability of the questionnaire answers. The study followed strict ethical guidelines, assuring respondents' anonymity and freedom of participation. Participants were informed of the study's goals, their freedom to withdraw at any time without prejudice, and the confidentiality of their responses. This methodology, despite its limitations due to non-probability sampling, ensures systematic and ethical data gathering, which is required for trustworthy and meaningful studies of Moroccan healthcare professionals' viewpoints. The results obtained using this methodology will be presented and analyzed in detail in the next section.

III. RESULTS and DISCUSSION

The study's findings, aimed to investigate the opinions of Moroccan healthcare professionals. Understanding their perspectives, challenges, and recommendations is critical for informing healthcare policy and enhancing care delivery in that country. As a result, the study offers the main findings as well as the detailed studies that followed. A survey of 95 health professionals revealed an average age of 43, with 51.58% female and 48.42% male. The majority (70.53%) were nurses or healthcare technicians, followed by physicians (23.16%). A smaller percentage (6.32%) represented other professions. 85.26% were in the public sector (figure 1), and 45.42% had 11-20 years of experience in their respective fields.

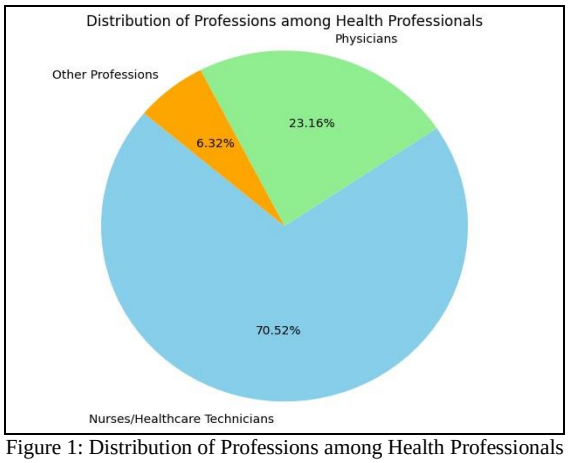

Figure 1: Distribution of Professions among Health Professionals

The results demonstrate that 89% of health professionals thought that lifelong learning can helps them to reduce everyday life stress (figure 2).

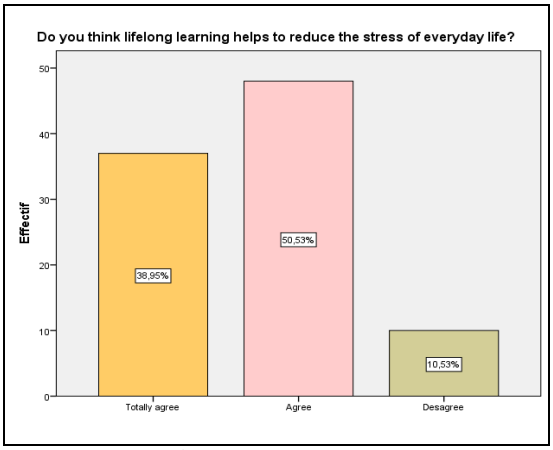

Figure 2: Lifelong learning and reducing stress

This finding cohobates with others studies which demonstrates that Lifelong learning can significantly reduce stress by promoting continuous personal growth, a sense of purpose, cognitive benefits, social interaction, and adaptability [13]. Also, it allows individuals to develop new skills and knowledge, leading to a sense of fulfillment and accomplishment. Engaging in intellectually stimulating activities can improve cognitive function, provide mental stimulation, and foster social interaction [14]. Furthermore, lifelong learning fosters adaptability and resilience, essential traits for coping with stress and navigating life's challenges [15]. So, lifelong learning provides individuals with the tools to lead fulfilling, stress-free lives. Regarding the result on the contribution of lifelong learning to the development of society, more than 96% are agree with this point which is similar with a study conducted by Lim and his colleagues who considered lifelong learning can foster a skilled workforce, social cohesion, healthier lifestyles, innovation, creativity, civic engagement, and environmental sustainability. It bridges socioeconomic gaps, encourages critical thinking, and empowers individuals to address global challenges [16] (figure 3).

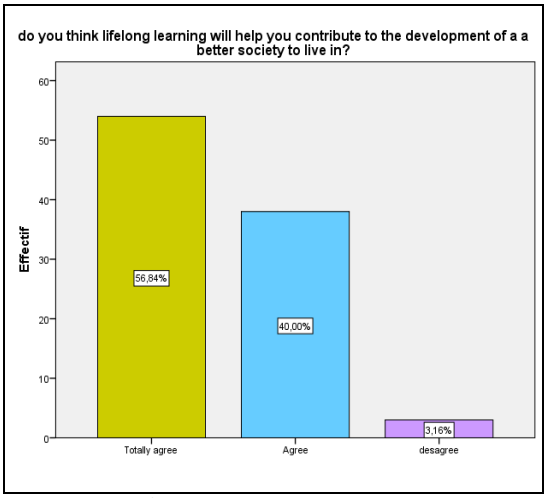

Figure 3: Lifelong Learning and society development

Also, 16% of healthcare professionals are proactive in their learning process, demonstrating self-reflection, continuous improvement and impact on patient care. This proactive approach benefits professional development and the quality of patient care, underlining the importance of fostering a culture of proactive learning [17]. Concerning the impact of integrating artificial intelligence in order to improve lifelong learning, more than 93% believed that has the potential to have a significant impact on lifelong learning in the health sciences, making it easier for professionals to stay current and give their patients the best care. Moreover, Brodeur and colleagues' research highlights the importance of changes in the educational environment for teacher professional development, including the introduction of new pedagogical tools like information and communication technologies. They suggest that lifelong learning can help healthcare professionals stay updated with technological advancements and provide quality patient care [18]. Another study also suggests three unique instructional techniques for cardiologists and fellows-in-training. Professional certification institutions should support lifelong learning methods that cater to the needs of the healthcare system and professionals [19]. Health professionals may keep current on the most recent research and best practices, and give their patients the best care possible, by employing AI to enable lifelong learning [20]. To stay current and effective in their work, professionals must, however, be cognizant of the limitations of AI and continually improve their own knowledge and abilities. These considerations highlight the significance of adapting learning taxonomies, such as Bloom's, to effectively include artificial intelligence into the training of health professionals.

Artificial Intelligence (AI) is revolutionizing health sciences education by addressing individual gaps in understanding and transforming the role of health sciences educators from knowledge transmitters to facilitators of interaction. AI's personalization and adaptability offer significant benefits, especially for students with special educational needs [21]. By continually adjusting its approach, AI promotes comprehensive educational inclusion, meeting the unique challenges of each participant [22]. AI's functionalities reflect pedagogical theories such as constructivism and behaviorism, emphasizing active knowledge construction and reinforcement-based learning [23]. AI also enhances social constructivism by introducing collaborative learning opportunities through AI-based educational platforms [24]. Bloom's Taxonomy, a long-standing framework for developing learning objectives, gains new relevance with AI integration. AI assists learners in assimilating essential facts and concepts interactively and engagingly at lower levels, while providing intellectual challenges tailored to each learner's skill level at higher levels [25]. AI enhances the application of Bloom's Taxonomy by utilizing rapid analytical capabilities to personalize learning experiences according to each learner's proficiency. AI also enhances interactivity and learner engagement through simulations and educational games, and improves the evaluation process by providing contextualized assessments that adapt to each learner's specific skills [26] (figure 4).

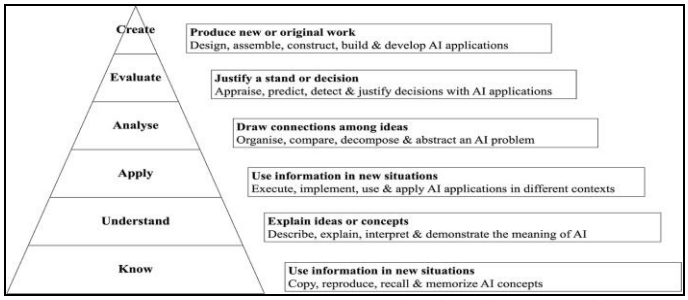

Figure 4: BLOOM'S Taxonomy with Artificial Intelligence Model [1]

As technological advances are made in health sciences education, artificial intelligence (AI) is predicted to play an increasingly important role. Personalized learning experiences for students are one of the most influential areas. AI can analyze massive amounts of data to tailor content and teaching and learning strategies to each student's specific needs, improving comprehension and retention. However, with these advances come serious ethical considerations. The application of AI raises concerns about data privacy, algorithm bias and the risk of over-reliance on technology in education. Educators and governments must proactively address these issues to ensure responsible and ethical use of AI in health science education. Furthermore, AI integration should not replace human contact and mentoring in education. While AI can enhance learning experiences, it cannot fully be up to the challenge of the ongoing guidance and subtle support provided by human educators. Therefore, a balanced strategy combining AI-driven personalization and human interaction is essential for the future of health sciences education. The human brain excels at critical thinking, ethical reasoning and understanding complex social processes. However, AI systems are particularly skilled at processing and analyzing large amounts of data, identifying patterns and making predictions. Therefore, combining the powers of the human brain with the possibilities of AI algorithms can bring even greater benefits.

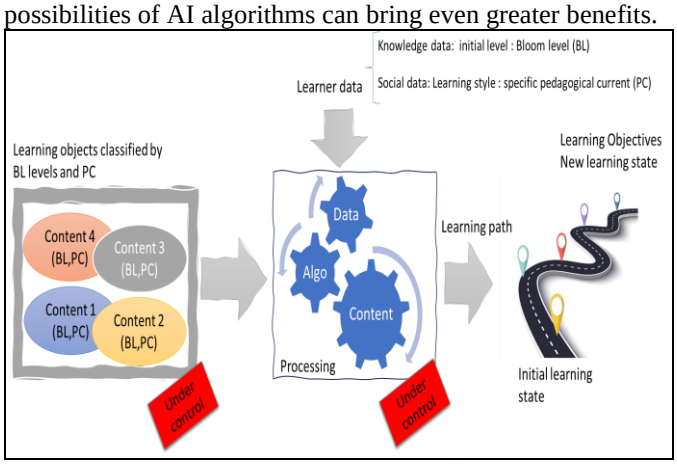

Figure 5: A comprehensive learning framework

The concept of a comprehensive learning framework involves considering individual data, including the learner's initial knowledge level and social data, as well as their specific educational trends [27]. This allows educators to adapt learning objects to individual needs, optimizing the learning path. This holistic approach enables learners to effectively progress their knowledge and skills, balancing current understanding with learning objectives (figure 5).

IV. LIMITATIONS AND ETHICAL CONCERNS

The ethical challenges introduced by AI in health education would include algorithmic bias, data privacy, and over-reliance on AI. For example, algorithmic bias could reinforce disparities in healthcare education, if trained on a dataset that consisted of bias. To reduce this, diverse training data and fairness audits are important. Privacy of data is another issue, as extensive AI systems are based on vast data collections, raising issues related to secure storage and usage of sensitive information. Institutions must therefore have very efficient encryption practices and comply with the data protection regulations to maintain trust. A disadvantage of AI is that it often reduces critical thinking and interpersonal skills in healthcare professionals. Even if the activities carried out are mostly data-driven decisions, human educators create spaces for the development of empathy, ethical reasoning, and creative problem-solving. That is why it is also important to make sure these two demands are balanced so as not to lose these in that effort.

Emerging technologies complementing AI in health sciences education would include its integration with augmented reality and virtual reality. These technologies would generate immersive simulation environments designed for clinical training to help bridge the gap between theory and practice. To refine the fruits of AI, interdisciplinary collaborations of AI developers, educators, and healthcare professionals would be important. To further the research breadth of AI, investigations in various healthcare systems across the world will ensure an equitable and effective adoption, allowing realization of the potential of AI in transforming health sciences education.

Future research will focus on emerging technologies complementing AI in health sciences education, such as the merging of AI with augmented reality and virtual reality: this could create immersive simulation environments for clinical training and bridge the gap between the theoretical world and actual practice. Interdisciplinary coalitions among AI developers, educators, and healthcare professionals are critical toward refining AI tools. This expansion of the research horizon of AI into different healthcare systems across the world guarantees equitable and effective adoption, bringing to fruition the beneficial potential that AI has to transform health sciences education.

As regards the use of technology advancement in health science education, future research should examine emerging technologies that complement AI. For instance, how has AI been integrated with augmented reality and virtual reality? Such can create an immersive simulation environment for clinical training to bridge the gap between theory and practice. To refine the fruits of AI, interdisciplinary collaborations of AI developers, educators, and healthcare professionals are important. This implies including a broader scope of research with relevant AI healthcare systems across the globe to ensure an egalitarian and effective acceptance of AI transformation in health sciences education.

V. PERSPECTIVES

Emerging technologies complementing AI in a particular health sciences education will be integrating AI and augmented reality and virtual reality. Such would produce an immersive simulation environment for clinical training, which would probably close the gap between theory and practice. It would also be essential to broaden one's interdisciplinary collaborations among AI developers, educators, and healthcare professionals for the betterment of the refinement of AI tools. The wider stretch of research on AI can expand into the very diverse health care systems in the world for an application that is fair and effective, which can give the full dimension of what AI could do for health sciences education.

VI. CONCLUSION

Finally, the incorporation of artificial intelligence (AI) into health sciences education is transforming instructional design. Combining AI adaptability with Bloom's Taxonomy improves interactive knowledge acquisition and personalizes learning experiences. This dynamic approach not only improves teaching methods, but also opens up opportunities for engaging health sciences education. Moreover, lifelong learning, a concept based on self-directed instruction, is being highlighted in the age of AI, allowing healthcare practitioners to provide safe, effective care while lowering costs and improving patient outcomes.

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