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# PRESCRIPTION

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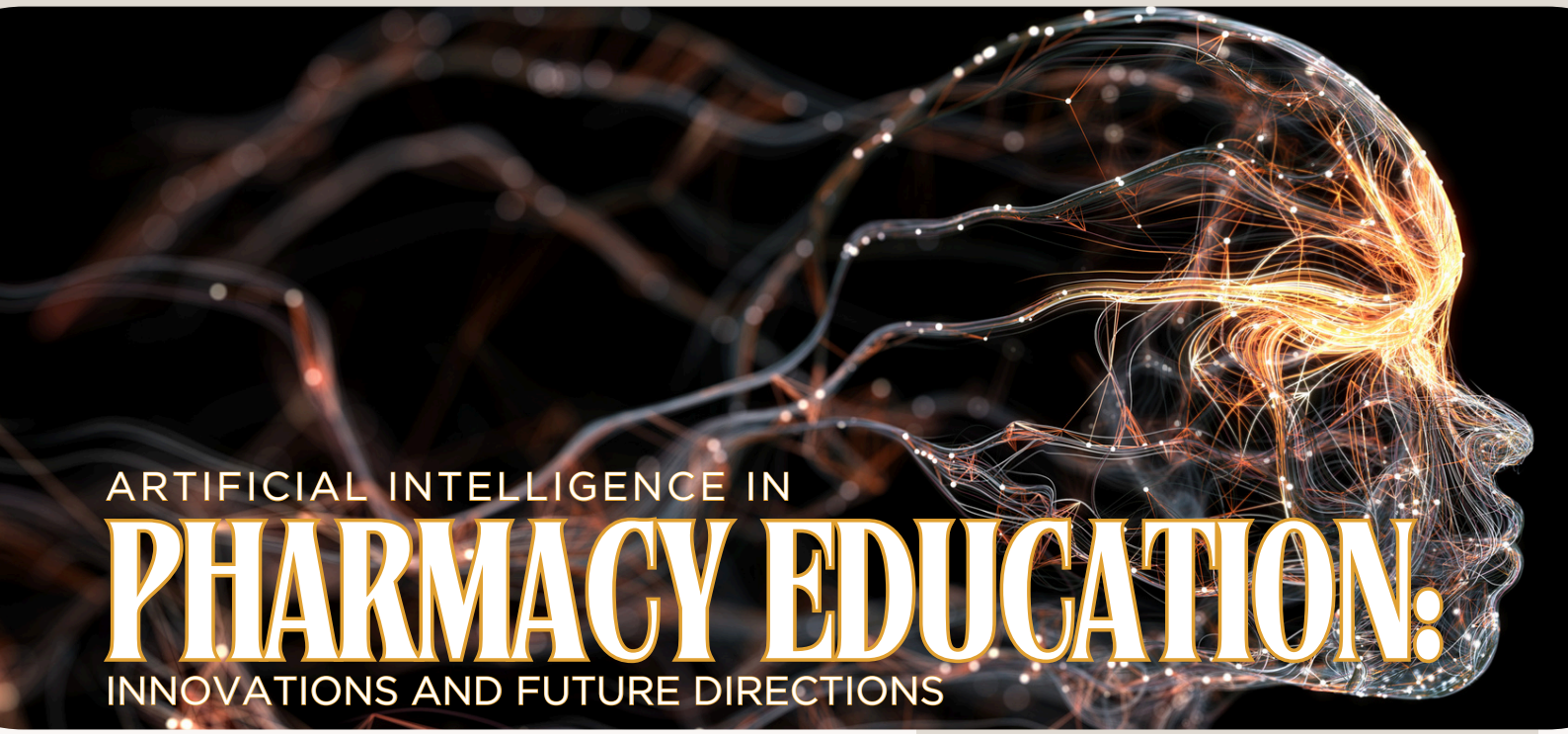

## ARTIFICIAL INTELLIGENCE IN PHARMACY EDUCATION: INNOVATIONS AND FUTURE DIRECTIONS

By: Assoc. Prof. Dr. Mathumalar Loganathan

Artificial Intelligence (AI) is profoundly transforming pharmacy education, presenting numerous opportunities and complex challenges for pharmacy institutions worldwide. In countries like Switzerland, innovative approaches and the integration of AI in pharmacy education are reshaping the educational landscape, particularly in digital health, AI-driven pharmaceutical research, and robotics in pharmacy practice. Moreover, Switzerland is home to major pharmaceutical companies such as Novartis, Roche, and Lonza, which are heavily investing in AI for drug development and patient care. These companies collaborate with Swiss universities to integrate research and AI-based learning tools into pharmacy education. This strong academic-industry partnership positions Switzerland as a key player in AI-driven pharmacy innovation.

## In this issue

The following outlines my four key areas of focus on contemporary AI-driven technologies that are revolutionising pharmacy education and providing learners with immersive experiences that redefine the future of pharmacy practice.

## 1. VIRTUAL PATIENT SIMULATIONS (VPS)

Virtual Patient Simulations (VPS) refer to computer-based simulations that mimic real-life patient interactions. These simulations are typically screen-based rather than fully immersive. Advanced AI-driven patient simulations enable pharmacy students to engage in clinical decision-making and medication therapy management within risk-free environments.

For example, using Nonlinear Mixed-Effects Modelling (NONMEM), one can simulate the intake of a high-fat meal, which may delay the absorption of a lipophilic drug, leading to altered bioavailability and systemic exposure across different patient groups. Virtual patients can present with complex medication profiles, comorbidities, and diverse demographic characteristics, allowing students to prepare for real-world pharmacy practice challenges.

## 2. VIRTUAL REALITY (VR)

Virtual Reality (VR) is a computer-generated immersive environment that students can interact with, often using headsets such as Oculus, HTC Vive, or Meta Quest, along with hand controllers. Students experience a heightened sensory perception within realistic, interactive 3D environments that facilitate training, skill development, and simulation-based learning.

Imagine a pharmacy education scenario where students are transported into a futuristic pharmacy setting. As they step into this virtual pharmacy, they find themselves in an elegantly designed space filled with advanced pharmaceutical technology. The ambience is bright and welcoming, with interactive displays showcasing medication information and health resources.

In this VR setting, the students approach a virtual pharmacist powered by AI. The avatar is equipped to provide tailored counselling based on their health profiles, preferences, and potential medication interactions. As the students interact with the virtual pharmacist, they receive guidance on the appropriate medications for a simulated health condition. The AI system analyses their previous prescriptions, allergies, and lifestyle factors, ensuring that the recommendations are personalised and relevant. The students learn to assess drug interactions and develop a deeper understanding of pharmacotherapeutics in real time, applying theoretical knowledge to practical scenarios.

Additionally, through this experience, the students explore various medication options, examining their chemical structures, efficacy, and side effects using interactive 3D models. This hands-on approach reinforces their understanding of pharmacology while enhancing their communication skills as they practice counselling and educating patients about their medications.


This image depicts a futuristic pharmacy education session titled "Applied Pharmacometrics in Drug-Food Interaction," where students engage with Virtual Reality, interactive simulations, and predictive modelling using software such as NONMEM, Simcyp, or GastroPlus. The session is guided by a remote expert who is projected as a hologram.

## 3. INNOVATIVE USE OF ROBOTS IN CLASSROOM TEACHING

As pharmacy education continues to evolve, the integration of robotics into classroom settings has emerged as a novel approach to enhancing experiential learning for students. Robots equipped with AI capabilities are being utilised in various educational institutions to assist in teaching pharmacy concepts and practical skills.

One notable example is the use of the Robotic Learning Assistant (RLA) in pharmacy schools. The RLA is designed to engage students in interactive learning experiences. It can simulate patient interactions, allowing pharmacy students to demonstrate their counselling skills in a safe environment. Through role-play, students receive real-time feedback on their communication techniques and clinical reasoning. These hands-on experiences not only build their confidence but also reinforce the importance of patient-centred care.

Furthermore, robotic teaching assistants can help demonstrate complex concepts in pharmacology. For example, a robot programmed to illustrate the mechanisms of action of various drugs can provide students with visual and interactive learning experiences. This enhances understanding while making the learning process more engaging and enjoyable.

Another example is the implementation of robotic simulators in pharmacy laboratories. These robots can mimic the dispensing process, allowing students to observe and participate in medication preparation and administration. For instance, the MedBot, a robotic dispensing system, demonstrates the steps involved in compounding medications, highlighting the importance of accuracy and safety in pharmaceutical practices. Students can interact with MedBot to learn about various drug formulations and understand the intricacies of dosage calculations.

Additionally, some educational institutions are exploring the use of telepresence robots, such as the Double Robot, to facilitate remote learning and collaboration. These robots enable pharmacy students to participate in lectures and discussions from different locations, ensuring that distance does not hinder their access to quality education. By using telepresence robots, students can engage with instructors and peers in real time, fostering a sense of community even in virtual environments.

## 4. PERSONALISED PHARMACOTHERAPY LEARNING

AI algorithms are now being employed to analyse pharmacy students' performance, creating customised learning pathways focused on pharmacology, therapeutics, and patient care. For instance, an AI platform can assess a student's understanding of complex topics and suggest specific resources or practice questions that target their weaknesses, thereby facilitating a more personalised and effective learning experience. Cognii, for example, uses natural language processing (NLP) to evaluate students' responses to open-ended questions. It then acts as a virtual tutor, guiding students through complex pharmacy concepts such as pharmacokinetics and drug interactions.

These adaptive systems are particularly appealing to Generation Alpha, who favour active engagement, instant gratification, and three-dimensional virtual reality interactions, which promote effective self-learning and memory retention. As a result, these technologies help future pharmacists master critical clinical concepts at their optimal pace.

SOURCE OF INFORMATION:

International Pharmaceutical Federation (FIP). Proceedings of the 81st FIP World Congress of Pharmacy and Pharmaceutical Sciences; 2023 Sep 24-28; Brisbane, Australia. Pharmacy Education. [Internet]. Available from: https://www.fip.org

# Let's check your understanding on this article

WE PREPARE SOME QUIZZES FOR YOU

## Quiz 1: Virtual Patient Simulations (VPS)

Question: What is the primary advantage of AI-powered Virtual Patient Simulations (VPS) in pharmacy education?

A) Replaces the need for real-world clinical practice
B) Provides risk-free environments for clinical decision-making
C) Eliminates the need for supervision
D) Focuses on theoretical knowledge without practical application

• Answer (B)

## Quiz 2: Virtual Reality (VR) in Pharmacy Education

Question: How does Virtual Reality (VR) enhance pharmacy education?

A) By creating immersive, interactive 3D environments for skill development
B) By replacing human instructors with AI-powered robots
C) By providing automated grading for pharmacy exams
D) By limiting student interactions to computer-based learning

• Answer (A)

## Quiz 3: Use of Robots in Classroom Teaching

Question: What role do robotic assistants play in pharmacy education?

A) They replace human educators in teaching pharmaceutical sciences
B) They help students develop patient counselling skills through interactive role-play
C) They dispense medications in real-world pharmacy settings
D) They eliminate the need for practical hands-on training

• Answer (B)

## Quiz 4: Personalised Pharmacotherapy Learning

Question: How does AI-based personalised pharmacotherapy learning benefit pharmacy students?

A) By analysing student performance and tailoring learning experiences
B) By standardising the same learning approach for all students
C) By focusing on memorisation rather than application
D) By automating pharmacy exams without feedback

• Answer (A)

## *Biography:*


Dr. Loganathan, a trained public health pharmacist specialising in clinical research, obtained her PhD from Imperial College London in 2012. She currently serves as the Programme Lead for the Bachelor of Pharmacy (Hons) degree. She plays a pivotal role in health services research and health systems strengthening, focusing on optimising medication use, improving healthcare delivery, and informing policy decisions.

She has authored over 70 articles, primarily as the corresponding or first author, with the majority being peer-reviewed and published in high-impact journals within the field of pharmacy practice. Currently, she supervises postgraduate students and remains actively involved in advancing pharmacy education and research. In 2023, her paper on COVID-19 vaccine cold chain management was recognised as a Top Impactful Paper by the Journal of Pharmaceutical Policy and Practice.