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Original Research Article

## Role of Pharmacy Education in Overall Development of Students in Research and Other Prospects

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**Abstract:** The perspective, experiences and insights of educators from various backgrounds, origin and educational levels were sought regarding the role of pharmacy education in providing pharmaceutical research and development workforce. These reforms must be accompanied by robust systems to assure that the quality of educational structures, processes and outcomes will produce competent pharmacy graduates in the future. It is also considered imperative that pharmacy academic institutions should establish collaboration with the drug development units, the pharmaceutical industry and government agencies for sustainability and positive research outcomes.

**Keywords:** Development and research; Pharmacy education; Pharmaceutical industry; Pharmacy training; Syllabus etc.

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## INTRODUCTION

The pharmacy profession has gone through many changes in recent decades. Pharmaceutical education used to be product oriented but has had to adapt to the evolving pharmacy practice [1]. Complex and widely varying healthcare requirements mean that there are more challenges to come, which need to be reflected in pharmacy education. Clinical pharmacy practice to the profession had a significant impact on pharmaceutical education, making the profession more patient-oriented or even service-oriented rather than product-oriented as it was throughout history [2, 3].

### Pharmacy Education

The pharmacist is considered to be one of the allied healthcare team, where pharmacy is a profession that is composed of various basic sciences and health sciences such as chemistry, biology, physiology, nutrition, anatomy, social sciences and other biomedical sciences [4].

Pharmacists' roles in the community are to provide humanistic services by protecting, promoting and enhancing population health.

With a minimum of four years for accreditation [5], schools of pharmacy around the world provide fundamental education for pharmacists that are comprehensive and extensive to equip them with the proper clinical and pharmaceutical knowledge for their future career and crucial role in the Community. Nevertheless, pharmacists' educational outcomes of each school around the world mostly share the same themes [6].

### Pharmaceutical Research and Development

Research and development (R&D) is a broad term that is used by any institution to discover solutions aiming to improve and develop the current resources and bring new knowledge, validate existing knowledge and create new products or technologies. In pharmaceutical companies, R&D refers to the initial steps looking for or modification

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of molecules to treat a certain disease until the last step of making a product available in the markets [12]. It is carried out to increase knowledge through searches for new molecules, modification of available molecules and development of current methods to improve production. The process of finding new molecules and medications for the many diseases around the globe is a very long process that involves many steps and phases. These processes are carried out by scientists, mainly biologists and chemists, along with a variety of specialties such as pharmacology, statistics, toxicology, genetics and others [13].

### Pharmacists in R&D

Pharmaceutical industries offer many opportunities for pharmacists to use their specialist skills in numerous roles. The pharmacist may pursue roles in various areas such as pharmaceutical formulation development, clinical manufacture, R&D, quality assurance, project management, regulatory affairs, pharmacokinetics and drug metabolism, medical informatics, marketing and sales.

### Work in R&D

The personnel in R&D departments conduct lab-scale experiments to develop new products including preformulation and formulation studies, perform scale-up and technology transfer of developed products, assist in troubleshooting of old products and launching of new products, maintain laboratory instruments and equipment, and demonstrate an understanding of operational hazards. Finally, they conduct literature reviews and research, and implement Good Manufacturing Practices and Good Laboratory Practices [13].

The personnel in R&D departments conduct lab-scale experiments to develop new products including preformulation and formulation studies, perform scale-up and technology transfer of developed products, assist in troubleshooting of old products and launching of new products, maintain laboratory instruments and equipment, and demonstrate an understanding of operational hazards. Physical chemistry of pharmaceutical systems is related to optimization and enhancement of physicochemical properties of old and new drug delivery systems, and biopharmaceutics is the study of the biologic effects of drugs and various dosage form factors [8, 14]. Pharmacokinetics and pharmacodynamics cover the science of drug concentration and therapeutic effect and relations between the body and the drugs [15]. Moreover, accurately performing pharmaceutical calculations is a critical component in providing patient care in every pharmacy practice, hence, to have a complete understanding of various types of calculations,

which are involved in dispensing, it is desirable that the pharmacist should have a thorough knowledge regarding the mathematical and analytical skills including concentration, titration and dilution.

Moreover, accurately performing pharmaceutical calculations is a critical component in providing patient care in every pharmacy practice, hence, to have a complete understanding of various types of calculations, which are involved in dispensing, it is desirable that the pharmacist should have a thorough knowledge regarding the mathematical and analytical skills including concentration, titration and dilution. This will set them up to deal with different calculations that are needed to correctly dispense prescriptions and patient specific drug dosing. Physicochemical properties of drugs, evaluation of drug dosage forms, chemical kinetics, principles of solubility and drug delivery systems are also skills that the pharmacist possesses [14, 15].

## MATERIALS AND METHODS

A community diagnostic survey in an urban area practice area was conducted by Jodhpur, Rajasthan (India). We surveyed their health status and demographic factors of their diseases for a total of 1000 families and information related to their current health status and internal disease status etc. was collected. Data were analyzed by appropriate instruments.

### Approach to Address the Challenges

There have been laudable efforts to address some of the shortcomings of the current pharmacy education system in many developing countries. Notwithstanding, we propose a six-step 'TARGET' approach to overcome the deficiencies of pharmacy education [21].

The six steps are as follows:

- Transform our views on leadership in pharmacy education,
- Acknowledge the shortcomings of pharmacy education and audit the current pharmacy syllabi accordingly,
- Re-establish the professional relevancy of pharmacy education,
- Gather together stakeholders in pharmacy education,
- Elucidate the sets of roles and responsibilities expected of graduate pharmacy students,
- Tackle new health challenges that arise as responsible members of the healthcare team.

## RESULTS

The perspective, experiences and insights of educators from various backgrounds, origin and educational levels were sought regarding the role of pharmacy education in providing pharmaceutical research and development workforce.

The processes carried out by scientists, mainly biologists and chemists, along with a variety of specialties such as pharmacology, statistics, toxicology, genetics and others were studied and analyzed.

Literature reviews and research, and implement Good Manufacturing Practices and Good Laboratory Practices were reviewed.

A number of countries around the world are currently undertaking major reforms in pharmacy education due to the changing landscape of health and healthcare delivery. These reforms must be accompanied by robust systems to assure that the quality of educational structures, processes and outcomes will produce competent pharmacy graduates in the future.

It is also considered imperative that pharmacy academic institutions should establish collaboration with the drug development units, the pharmaceutical industry and government agencies for sustainability and positive research outcomes.

## DISCUSSION AND CONCLUSION

Nevertheless, every pharmacy education programme develops the knowledge, skills, abilities, behaviors and attitudes of the graduate to apply the foundational sciences (biomedical, pharmaceutical, administrative and clinical sciences). 17 Initial educations of pharmacists still covers the fundamental sciences that give them the proper knowledge and equip them to be competent to be involved in technical and industrial work. Therefore, pharmacists can be competent to work in R&D but not yet proficient or expert. As the case in all professions, postgraduation self development, involvement in training programmes, and training provided by the pharmaceutical institutions could develop them to be more proficient in the field. It is also imperative that pharmacy academic institutions should establish collaboration with the drug development units, the pharmaceutical industry and government agencies for sustainability and positive research outcomes.

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