Review Article

Design of Skill Enhancement Module for Pharmacy Students - Need of the Hour

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ABSTRACT

Skill industries, such as manufacturing and services, are growing at a rapid rate. It is estimated that there is a huge demand for skilled employees in the future. But India's skilled workforce is very low. The country is currently facing a dual dilemma of the extreme shortage of highly-trained, high-quality work yet as non-employment of large parts of educated people with very few or no job skills. The issue of skill development in India is so relevant to demand and supply levels. The pharmaceutical sector is developing at a rapid pace, but challenges faced by the pharmaceutical industries are outdated skilled workforce. This is due to the outdated curriculum followed in the majority of universities and lack of industrial exposure, limited industry interfaces, lack of appropriate skills and education. Thus there is a need to develop a skill development module and incorporate it as a training program. Total quality management and innovation ecosystem to be introduced in pharmacy to improve the current situation. This article emphasizes on skill gap requirements, developing skill modules for pharmacy students, design of a curriculum, introduction of practice school, various strategies and pedagogical techniques to be introduced to develop the skills of the students and make them ready for specialised job roles.

Keywords: Skill, Curriculum, Design, Learning, Pharmacy education.

INTRODUCTION

Skill development is vital for economic progress and social development. In the future, young people should acquire the required skills and education to be able to job ready in the workplace. The country is currently facing a dual dilemma of the extreme shortage of highly-trained, high-quality work, yet as non-employment of large parts of educated people with very few or no job skills. The issue of skill development in India is so relevant to demand and supply levels. Already enormous gap is there between the academia and requirement of the industries due to different reasons such as insufficient training and infrastructure, lack of appropriate skills and education, outdated academic curricula, shortage of quality academics, limited industry interfaces, inadequate standards, etc. India is also facing a huge task of developing a skill development system that may train the workforce effectively to satisfy the requirements of the industries. The workforce must be trained at all levels, from the high-level specialised skills to the low-level skills, Moreover, these skills have to be effectively related to available job opportunities. The skill development system in India is concerned with several problems associated with sensitivity, knowledge, interpretation, price, quality and measure.[1]

The Indian pharmaceutical sector is one of the most competitive, globally. It is crucial to identify and resolve its skilling challenges in time. The pharmaceutical sector is set to develop at a rapid pace. But the challenges lying ahead are many. One such area is the lack of updated skill sets among the workers

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working in the Industry. The Pharmaceutical Industry is currently struggling to maintain its talent and to provide a stable career path with the aid of competitive pay packages. The fact is that the need for expertise is far higher than their supply. Adequately trained, skilled and motivated staff will always be at the leading edge in safe and effective healthcare provision and in fostering the growth of the Indian pharmaceutical industries.[2]

A skill gap is a significant gap between employee skills and the attributes and capabilities they currently have. In India, there is a considerable disparity in skills between industry demand based on rapid economic growth and the kind of skills that young people learn through different education and training. Though we have sufficient manpower, they are not skilled enough to get a job. The employable talent in the pharma sector has been decreasing in last few years. India's young people's empowerment has stagnated over the previous three years, with approximately 46% of those job-ready. In the last few years, the employability situation has not changed, indicating the need for more effective measures.[3]

National skill development cooperation has conducted a skill gap study over 2010-2014 and there is a huge demand for skilled employees by 2022 across 24 key sectors.[4] By 2030 more than 90% of India's GDP will be obtained from skill intensive industries such as manufacturing and services. India's skill workforce is beneath 5%.[5] In pharmaceutical sector, the workforce in 2013 was 1.86 million and it is expected to increase to 3.5 million by 2022.[6]

The skill requirement for pharmaceutical Industry in production department are efficiency in working with equipment, technology-friendly, attention to detail, strong analytical skills, efficient organizational skills and focus on quality. The skill requirement for pharmaceutical Industry in marketing department are appropriate product and industry knowledge, understanding physicians needs and suggest suitable offerings, strong communication and marketing skills, working knowledge of computer, patience and perseverance, awareness of regulatory norms, goal oriented and ability to work with targets.[6]

Pharmacy education in India doesn't fulfill the requirements of the pharmacy students.[7] The current pharmacy education in India produce outdated and unskilled professionals. Thus lack the abundant required expertise and critical thinking. The pharmacy colleges in India follow a curriculum which are not up to the world-wide standards. The curriculum needs to be revised according to the global requirements. The pharmacy council of India has introduced practice school in the syllabus in the VII semester to improve the skills required by the Industry.

We can improve the present situation by application of Total quality management (TQM) and innovation ecosystem in pharmacy education. Additional significance to be given for clinical and practical training and included in the curriculum. The knowledge of a pharmacy student ought to be current and invariably change of his information is important. A student must learn to assess himself and try to constantly advance his knowledge levels.[8,10]

As per WHO, training is required if there is a gap between current status and desired status, to maintain the level of competence and to respond the new technologies and methods.[7,9] A good training program is always targeted to address the performance problem. Principle objectives of the training are to enhance the knowledge, improve the attitudes and work behaviour, and build and strengthen the skills. Here the gap is little or no interaction between academia and industry and outdated course contents. So, training programs should be more focused on current industrial needs. Here it demands proper designing of training programs incorporating both fundamental knowledge and practical aspects which in turn will pave the way for the up-gradation of pharmacy education.[7,10-12]

Employability Skills for Industry

Employability skills state the skills needed by a person to secure and maintain a job. The two primary considerations of recruiters these days are recruiting good employees and training them. There is a difference amongst the skills required for the job and those acquired by candidates known as the skill gap that is the actual issue for human resource managers and industry persons trying to hire competent skilful workers. Whereas industry people will like to hire persons who are trained and prepared for work, they are sometimes ready to arrange for the specialised, job-specific training required for those lacking such skills. Employability has become a way larger challenge than unemployment, probably because there are still massive vacancies in industries, however lack of employable candidates.

The study conducted in Nagpur region to assess employability skills among pharmacy students. The outcome of the study recommended that just technical knowledge is not enough for getting a job, however, students ought to focus on adding importance for employability skills. Only 22% of respondents were familiar regarding these skills, whereas 66% were very less aware, and 12% were completely unaware about of the conception of employability skills.[12]

Presently, employers in each industry industry stress the necessity for workers with a definite set of primary skills. These comprise a robust academic grounding at the side of individual talents like teamwork, problem solving, work ethic, and integrity. Employability denotes skills and attributes that build a person necessary to potential employers.[13]

The recruiters are avoiding the pharmacy students lacking the required skills. The condition needs to be improved immediately, and there is also a need to enhance the level of pharmacy students' abilities to help them get into active life, the domain of labour, and society, which turns into day-to-day extraordinarily competitive. What is required can be a paradigm shift, from a "supply stipulated" system to a "demand-determined" model, so that those who enter the employment will be better qualified and ready from the first day.[5]

The major job roles in the pharmaceutical industry are production chemist, quality control chemist and medical representative. The skill gaps for these are mentioned in Table 1.

The skill gaps can be bridged by implementing training programs, application of Total quality management and innovation ecosystem in the curriculum so that we can enhance the skills of the students and make them a skilled person.

Table 1: Skill gaps in production chemist, quality control chemist, and medical representative.[6]

Production and Quality Control	• Insufficient coordination towards quality management • Inadequate knowledge about intellectual property management • Lack of awareness regarding regulatory aspects • Poor people management and leadership skills • Lack of practical exposure to high-quality lab settings • Lack of appropriate communication skills • Poor task orientation • Insufficient information on relevant USFDA rules[6]
Sales, Marketing, Medical representative	• Convincing skills and objection handling • Relationship management • Basic information of logistics, commercial aspects, legal aspects, etc.[6]

Total quality management (TQM)

TQM is being called the most powerful management tool that is universally applicable and versatile. TQM is a universal manager in every aspect of life, and TQM has solutions to all the problems we face daily.[12] TQM is a tool to increase an organization's efficacy by including that person in the organization at each level so that they can function together. Synergistic partnership, continuous improvement, and self-evaluation, a method of ongoing process and management, are the TQM concepts that are most common in educational reform. The importance of engagement and understanding are the robust components of TQM. Self-evaluation is a vital part of TQM. Self-evaluation charts (SEC) is a statistical data which is to be done by each student in the form of a graphic representation or diagram that is a representation of their success in areas related to education. Seminars and presentations are the most essential tools for improving the quality of learning in an institution. A more current student-centered mastery plan based on TQM is given in the Figure 1.[7]

Innovation Ecosystem

The innovation system model stresses that the exchange of technology and information between individuals, companies, and organizations is central to a creative method. The two important components of constructing a successful ecosystem are innovation culture and entrepreneurship.[9] A simple illustration of how an innovative ecosystem function is given in the Figure 2.[14]

Figure 1: Student-centered mastery plan based on TQM.[5]

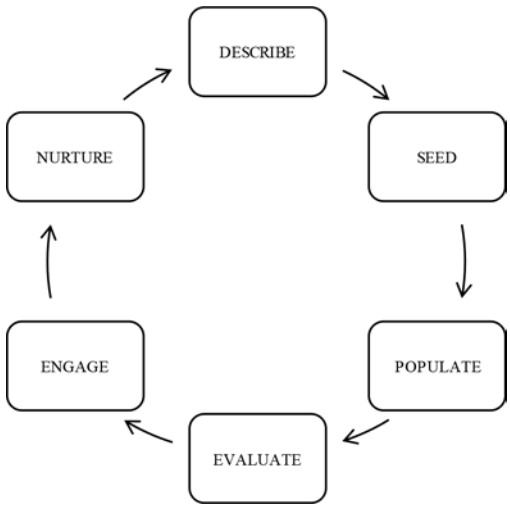

Figure 2: Demonstration of an innovation ecosystem cycle.[5]

Innovation Ecosystem comprises of three nodes[5,15]

Node 1: Inspire/Invest – an organization (enterprise) with a mission and purpose to encourage and invest in individuals and institutions.

Node 2: Invent/Innovate – an organization (institute) performing quality research in science and technology.

Node 3: Incubate/Market – an organization (company) to turn research results into economically and socially beneficial products and services.[7]

The function of institution of higher education in shaping regional innovation ecosystems:

1. Target at major challenges.
2. The strong role of the institute is crucial: focused on the Knowledge Triangle. Research, education, and innovation are synergistic.
3. Modernize the cooperation between Triple Helix: Academy – company – Cities.
4. Live experiments and inventions powered by users: focus on people and the creation of technologies.[7]

CURRICULUM DESIGN AND MODULE DEVELOPMENT

Curriculum is a design plan that is strategically organized, resulting in learner changes in four areas: Cognitive (knowledge and intellectual skills), affective (feelings and attitudes), interpersonal (behaviour and relationships with others), and psychomotor (physical skills).[16] Curriculum design includes organization of the modules of a curriculum and the process is cyclical.[17] The fundamental norm for the success of curriculum design process is four Cs: Clarity, Capacity, Consistency, and Commitment.[18]

There are numerous methods in which curriculum design can happen. The forward design by Tyler method, Backward design beginning with the material, Central design starting with teaching approach are distinctive methodologies.[19] Harden R. M. framed ten key questions that should be addressed during the development of a curriculum.[20] The traditional five-step method of ADDIE, the six-step framework of Kern offers guidelines of curricular design.[21] The educational strategies used advanced from Flexner Teacher-centered, Knowledge giving, Discipline- led, Hospital-oriented, Standard programme, Opportunistic model, SPICES (Student-centered, Problem based, Integrated, Community based, Elective and Systematic) model to the PRISM (Product focussed, Relevant, Inter-Professional, Shorter courses, Multisite, Symboitic) model.[17,22]

According to Kern, six steps in curriculum design are as follows:

- Description of education
- Assessment of targeted needs
- Development of goals and objectives
- Development of educational strategies / activities
- Development of appropriate methods of assessment
- Assessment of learners and finally providing feedback

Module development is not a linear process, but uses very precise techniques to carry out qualitative teamwork.[23] Modular approach is an established tool that helps students learn effectively and efficiently. Many subjects are taught with this approach.[24] The module can provide a learning experience of interest to both facilitator and student. The essential elements of a module include a statement of purpose, introduction to using the module, planned learning results, teaching-learning activities, media, time-table, learning tools, and evaluation plan and methods.[16]

The stages in curriculum development are implemented to develop a module also. Steps include:[25]

- Read and discuss choices, chat with colleagues and peers
- Decide on the module's goals and planned learning outcomes
- Exploring the material of the module
- Develop strategies for learning and teaching and appropriate support for learners.
- Focus on assessment
- Conducting cooperative research
- Collaborative work involving all stakeholders
- Strategy for evaluation and review.

The various models of curriculum evaluation can be applied to modules.

- Tyler's model
- Context, input, process, product model,
- Stake's model
- Roger's model
- Scriven's model
- Kirkpatrick's model

Kirkpatrick's model is capable of evaluating the effectiveness of the module that have been developed.[26]

IMPLEMENTATION OF DEVELOPED SKILL BASED CURRICULUM

The developed skill-based curriculum can be implemented using various pedagogical techniques and in the form of practice school.

Practice School

Practice school is an educational initiative trying to introduce industry perspective in education. Practice school involves practical based learning, which is essential to fostering more skilled, empathetic, confident, and experienced students. Practice school helps the students to get ready for industrial training through experiential and cooperative learning and education, under the guidance of industry experts and faculty. Practice school also aid and boost partnership and intellectual exchange between the academia and industry. The practice school helps a student to understand how the practice concepts learnt in the classrooms will be useful in a real-life situation and sensitize them to the expectations of workplace behaviour. It also creates awareness among students about their strengths and weakness in the work environment, as well as provide them with a platform to hone the skills before they enter the phase of industrial training. The benefits of practice school is summarized in Table 2.[27]

Table 2: Benefits of practice school.[27]

Benefits to students	• Learning through doing • Enhance skills in all ways • Career planning assistance • Add to working requirements of employment experience
Benefits to the Industry	• Stabilized supply of skilled workforce • Additional benefit and improved efficiency • Benefits for Human resource development • Approach to academic knowledge
Benefits to the college	• Responses for timely-modification of curriculums to meet industry needs • Development of the faculty • For R&D and consulting opportunities • industrial expertise and infrastructure access[27]

Objectives of Practice School

- To meet the constantly evolving demands and requirements of a career.
- To encourage students in new, open-ended real-life scenarios to learn through the application of the knowledge and skills they have.

The objective is achieved by the simulation of the industry environment into the process of education. It helps in redesigning the curriculum, including the inputs from the industry.

Practice school will enable student's smoother transition from academics to the professional world. It enhances inter-professional skills and leadership qualities. During the practice school, students are trained to develop them

- Problem solving, critical thinking and innovation abilities
- Curiosity to learn
- Communication skills
- Team work, responsibility, professional and ethical behaviour
- Attitude and discipline.

Team-Based Learning

Team-based learning (TBL) helps students to study before school and allows students to work in groups during their classes. Key benefits of this pedagogy include student engagement, strengthened communication skills, and better critical thinking skills. Team-based learning helps learners to acquire basic knowledge before college through achieving common unit expectations, scheduled preparation activities, and learner ability assessments. In the team-based learning curriculum, there are four main principles of successful implementation.[28]

1. The first concept is to organize and handle teams carefully. Continuity, varied tools and ability to communicate effectively are the key characteristics of team formation.
2. The second essential rule is that people and groups must be accountable for their success.
3. The third rule is that student input from faculty members must be provided consistently and promptly.
4. The fourth rule is that activities for group projects must facilitate training and team growth.

Elements of Team-based learning

- Teams - groups should be appropriately organized and managed
- Accountability - participants should be responsible for the quality of their personal or team work
- Feedback - regular and appropriate input to students
- Task structure – group tasks must facilitate both the training and team growth.[29]

Seven key aspects of TBL include group learning, guarantee of preparation, instant reviews, the concurrent problem solving in-class, project implementation task processes, reward framework and peer-review. Such factors lead to improved self-determined education, critical thinking, collaboration, interaction between

individuals, peer learning and problem-solving skills of the TBL participants.[30]

Team-based learning process

Phase 1 – Pre-class preparation includes lectures, screen casts, pre-class reading, e-learning resources.

Phase 2 – Readiness assurance process includes individual readiness assurance test (iRAT): individual MCQs, Team readiness assurance test (tRAT): team discussion of MCQs answers revealed by scratchcards, Team appeals and feedback.

Phase 3 – Application activities like team debate and discussion, problems build towards exam style questions, teams use concepts learnt in RAP to solve challenging problems.[29]

The Advantages and challenges of Team-based learning is given in Table 3.[30] Bingchen Lang and Lingli Zhan has done systematic review and meta-analysis in The TBL pedagology and results showed how successful TBL application was during the last decade in China's pharmacy institution. It has strengthened Chinese pharmacy students' theoretical values and diverse capabilities.[31]

Problem-based learning

Problem-based learning (PBL) is a method of education that focuses on self-directed learning, small groups discussing with facilitators, and problems in the acquisition of knowledge. This method can be an effective way in health-care education where students learn by working with practical cases.[32] This model was used to implement a learning model that can provide a change of attitude for students when the learning process takes place. PBL can be an alternative to overcome obstacles in achieving maximum learning outcomes. PBL also congruent with the concept of constructivism learning, which is to foster a creative and collaborative spirit, develop high-level thinking skills, increase understanding, increase learning independence, facilitate problem-solving, and enhance learning achievement. PBL has been proven to influence motivation, critical thinking, problem-solving, metacognition, and learning achievement.[33] In the Table 4, elements and outcome of Problem-based learning are listed.[35,36]

Table 3: Advantages and challenges of Team-based learning.[30]

Advantages	• Self-managed performance development • critical thinking • collaboration • interaction between people • peer learning • problem-solving skills.
Challenges	• Time pressures • Differing priorities • Student personalities • Unbalanced workload

Table 4: Elements and outcome of Problem-based learning.[35,36]

Elements	• Problems • Position of Students (writer, reader, leader) • Position of Facilitator/Tutor • Problems of learning • Oral/Written presentations • Self-Assessment • Peer Assessment • Facilitating evaluation[35-36]
Outcomes	• Useful, practical knowledge and expertise in task-solving • Medical reasoning and problem-solving skills • Lifelong, self-directed learning • Strong skills in teamwork[36]

Table 5: Advantages and challenges of Problem-based learning.[36-37]

Advantages	• Competency to solve problems • Skills for critical thinking • Self-directed learning • Collaborative working abilities • Motivation for learners • Verbal and written communication skills • Research skills[36]
Challenges	• Correct case formation • Preparation period • Facilitator accessibility • Monetary • Physical facility • Facilitator reliability • Team dynamics • Fulfilment of learning goals[37]

A Problem-driven and Student-centered Teaching Process

- The small group of students in the presence of a facilitator or mentor addresses the unstructured real-world problem
- Students are responsible for studying and collaborating with others to resolve problems
- Students classify known and unknown knowledge to solve problems
- Unknown information is analyzed using measured assets.[34]

The advantages and challenges of Problem-based learning are given in Table 5.[36,37] One disadvantage of PBL is to cause misconceptions due to students' self-

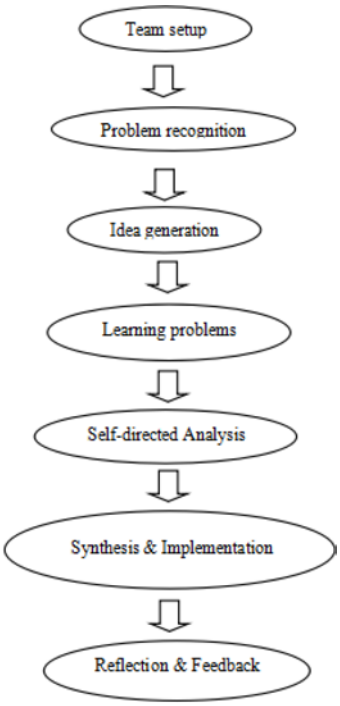

Figure 3: Problem-based learning process.[34,38]

directed learning. Mapping concepts can overcome these PBL weaknesses through the relationships and linkages between concepts that are clearly described. Making a concept map aims to instil materials and as an indicator to the extent of the students' understanding. Concept mapping is a graphics technique showing information that is hierarchically arranged and has connections between concepts in the form of graphics, images, or illustrations. The function of concept mapping is a tool to investigate what students already know in the form of concepts and used to measure the level of understanding as one of the learning achievements. Concept mapping is a strategy for meta-learning that allows students to independently learn, a term that parallel with the objectives of PBL. Furthermore, concept mapping is used as a suitable method for improve concrete learning. This is done in part by promoting information capture and incorporation as well as enriching meta-cognitive skills and student involvement.[33]

Problem-based learning with concept mapping technique has been shown to have a significant impact on students' activities based on the four domains of active learning namely engagement activities, cognitive abilities, responses to cognitive development, and responses to general learning outcomes.[33] Problem-based learning in the context of drug delivery course has proven to enhance the academic output of the student either directly or indirectly by rising the student's interest and perception of the subjects taught. It also improves the student's soft skills, their ability to think critically and develop their time management skills and confidence.[38] Tais F. Galvao has done Systematic Review and Meta-Analysis in PBL in Pharmaceutical Education, and the findings show that PBL students are performing better academically.[32] The steps involved in the problem-based learning process is shown in the Figure 3.[34,38]

Flipped Classroom Teaching Method

The flipped classroom is a pedagogical technique that uses electronic means such as online learning to provide lecture material to students at home and use class time for practical implementation activities.[39-40] It provides a learning environment that offers students a variety of means in which basic knowledge material can be learned as part of their homework and preparation for classroom meetings, whereas teachers use time for practical activities more efficiently.[40-41] The exercises in the classroom were designed to instruct students on how to implement the content in order to understand the material being taught more effectively. Such tasks could be individual or collective and shift the teacher from being a source of knowledge to a student learning facilitator.[42]

The flipped classroom offers space for collaborative learning, increased face-to face contact time with classroom students by reducing the amount of direct instruction used in a traditional classroom environment, thereby allowing students to actively participate in discussions or problem solving.[42-43] Flipped classroom approach is a technology based pedagogy consisting of two components: direct computer based student education outside the classroom through video lectures and engaging in team learning experiences within the classroom.

Flipped Classroom Process

Step 1: survey of students and parents to find out what internet access they have outside school. How will you provide for students who don't have access?

Step 2: Select your lesson to flip. Be sure it is concrete and definable. Avoid abstract or conceptual skills.

Step 3: Create support structures. Video lectures are fine but use more than just. Scaffold students so they learn how to find information and resources.

Step 4: Run through demo in class. Make sure everyone understands the model and what is expected.

Step 5: Have virtual office hours for students needing help. Share this with the students and parents.

Step 6: Provide classroom activities that reinforce what they learned. Activities should be engaging and cause them to problem solve and apply new knowledge.

Step 7: Survey students on the support, classroom activities, and experience it. Make it anonymous.[44]

Advantages of flipped classroom[45]

- Efficient use of class time
- Active learning opportunities
- Increased one-on-one opportunities
- Student engagement in learning
- Discuss different learning types.

Challenges of Flipped Classroom[46]

- Needs time and some technical skills
- Includes outside school connections to computers and web
- Student workload
- Excessively based on student trust.

  Yuan He *et al.* conducted a clustered randomized controlled study that improved the performance of the student, increased teacher-student interaction and developed positive student attitudes toward the experience. This can also improve the students learning interest in pharmacy and enhance their skill in self-study, as an important teaching model.[47]

Blended Teaching Model

Blended Learners concentrate on maximizing learning goals by incorporating the' right' software to suit a' right' way, so that' right' skills are transferred to the' right' person in the' right' period. The blended teaching incorporates conventional, pedagogically beneficial teaching activity; and a portion is replaced by blended courses.

CONCLUSION

Skill development module to be incorporated as training programs in curriculum as a part of practice school. Total quality management (TQM) and innovation ecosystem to be implemented in pharmacy education. Students should be aware of skills required for employability. The various pedagogical approaches to be practiced to develop self-directed learning, critical thinking and problem-solving capabilities. The New education policy 2020 includes changes to current system such as revamping curriculum, pedagogy, assessment, and student support for enhanced student experience. There will be shift towards competency-based learning and education.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

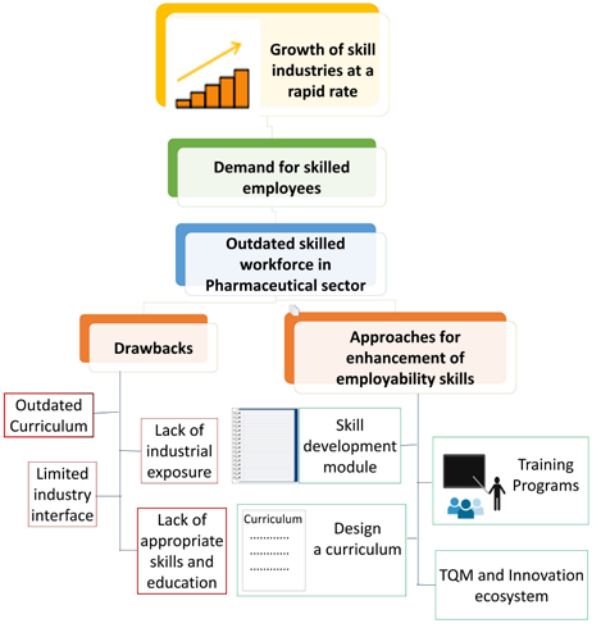
ADDIE: Analysis, Design, Development, Implementation, and Evaluation; **GDP:** Gross domestic product; **iRAT:** individual readiness assurance test; **MCQ:** Multiple choice Question; **PBL:** Problem-based learning; **PRISM:** Product focussed, Relevant, Inter-Professional, Shorter courses, Multisite, Symboitic; **RAP:** Readiness assurance process; **SEC:** Self-evaluation charts; **SPICES:** Student-centered, Problem based, Integrated, Community based, Elective and Systematic; **TBL:** Team Based Learning; **TQM:** Total quality management; **tRAT:** Team readiness assurance test; **WHO:** World Health Organization.

REFERENCES

1. Skill development and pharmaceutical education. National Institute of Pharmaceutical Education and Research (NIPER), Sector 67, SAS Nagar-160062 Punjab, India.
2. Pharma: high demand for skilled manpower in the Industry by, Ray Tapan, Director. General. Organisation of Pharmaceutical Producers of India.
3. India skill report 2020.
4. Balakrishnan A, Thunga G, Nair S, Kunhikatta V, Khera K. Bridging the gap between industry and academia in pharmaceutical education. Indian J Pharm Educ Res. 2018;52(4s):s7-s10. doi: 10.5530/ijper.52.4s.69.
5. Jishnu V, Gilhotra RM, Mishra DN. Pharmacy education in India: Strategies for a better future. J Young Pharm. 2011;3(4):334-42. doi: 10.4103/0975-1483.90248, PMID 22224042.
6. Human resources and skill requirements in the pharmaceutical sector.(2013-17,2017-2022).
7. World Health Organization. Designing and implementing training programs. Hum Resour Manag. 2012;52.0-52.
8. Harishankar Sahu, Akanksha Negi, Shivin Sultan, Neha Bala, Sagar Sahu. Pharmaceutical education in india: Current scenario. Int J Dev Research. March 2016;6(03):7049-52.
9. Palsokar MRGT. Evolution and evaluation of pharmaceutical education in India. Int J Pharm Sci Rev Res. 2017;43(2):224-7.
10. Tharappel L, Kaur G, Buttar HS. Pharmaceutical education in India: Past, present and future [internet] [cited 12/4/2022]. Available from: http://pci.nic.in/PDF-Files/NSP.pdf.
11. Chidambara Murthy KNC. Pharmacy Education system in India: Time to revisit teaching and training modules to meet global expectation. Indian J Pharm Educ Res. 2014;48(2):1-3. doi: 10.5530/ijper.48.2.1.
12. Awandekar NB, Trivedi RV, Umekar MJ. Employability skills assessment amongst pharmacy post graduates in Nagpur region. Int J PharmSci Bus Manag. Vol. 4; 2016.
13. Total Quality Management. Chapter 5 [cited Dec 21 2010]. Available from: http://www.wiley.com/college/sc/reid/chap5.pdf. p. 138-67.
14. Remesh A. Curriculum design principles for developing a module in medical education. Prog Med Sci. 2017;1(1):34. doi: 10.5455/pms.20171223064024 .
15. Kbcrf.co. [Homepage on the Internet]. In: Chennai. India: KBC research foundation limited; c2009 [cited Apr 9 2011]. Available from: http://www.kbcrf.co.in.
16. McKimm J. Curriculum design and development; 2007. Web source [cited October 2017] [cited 12/4/2022]. Available from: http://www.Faculty.Londondeanery.ac.uk/elearning/settinglearningobjectives/Curriculum_design_and_development.pdf,Retrieved.

17. Hamza Mo. Developing training material guide. Swedish Civil Contingencies Agency (MSB), Danagård LiTHO, Odeshog, Sweden; ISBN: 978-91-7383-303-5; 2012. p. 12.
18. Della F, Collin C. Medical education developing a curriculum for practice. Berkshire, England: Open University Press, McGraw-Hill Education; 2005.
19. Harden RM. Ten questions to ask when planning a course or curriculum. Med Educ. 1986;20(4):356-65. doi: 10.1111/j.1365-2923.1986.tb01379.x, PMID 3747885.
20. David EK. Curriculum development for medical education – a six-step approach. Available via https://www.amazon.in/Curriculum... medical-education-six-step/dp/0801893674.
21. Harden RM, Sowden S, Dunn WR. Educational strategies in curriculum development: The SPICES model. Med Educ. 1984;18(4):284-97. doi: 10.1111/j.1365-2923.1984.tb01024.x, PMID 6738402.
22. Torsten H, Neville Postlethwaitel T. The International encyclopaedia of education research and studies. 2nd ed. Vol. 7. Thousand Oaks, CA: Corwin Press; 1986. p. 3886-94.
23. Butcher C, Davies C, Highton M. Designing learning: from module outline to effective teaching. London and New York: Routledge; 2006.
24. Ricard VB. Developing learning modules for adults. J Adult Educ. 1990;18(2):1-5.
25. Hutchinson L. Evaluating and researching the effectiveness of educational interventions. BMJ. 1999;318(7193):1267-9. doi: 10.1136/bmj.318.7193.1267, PMID 10231262.
26. Khan TM, Anwar M, Mueen Ahmed KK. A perspective for clinical pharmacy curriculum development and validation in Asian developing nations. J Young Pharm. 2011;3(2):151-4. doi: 10.4103/0975-1483.80304, PMID 21731361.
27. Michaelsen LK, Sweet M. The essential elements of team-based learning. New Dir Teach Learn. 2008;2008(116):7-27. doi: 10.1002/tl.330.
28. Webinar on Understanding Practice school and its concept in UG pharmacy education organised by Pharmacy Council of India.
29. Faezi Seyedeh Tahereh, Moradi Kamran, Ghafar Rahimi Amin Ali, Akhlaghi Massoomeh, Keshmiri Fatemeh. The effects of team-based learning on learning outcomes in a course of rheumatology. J Adv Med Educ Prof. 2018;6(1):22-30. PMID 29344526.
30. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29344526%0Ahttp://www. PMID PubMed [cited 12/4/2022]. Available from: http://central.nih.gov/articlerender.fcgi?artid=PMC5757153.
31. Ansari MT, Rahman SA, Badgujar VB, Sami F, Abdullah MS. Problem based learning (PBL): A novel and effective tool of teaching and learning. Indian J Pharm Educ Res. 2015 June 23;49(4):258-65. doi: 10.5530/ijper.49.4.3.
32. Lang Bingchen, Zhang Lingli, Lin Yunzhu, Han L, Zhang Chuan, *et al* Team-based learning pedagogy enhances the quality of Chinese pharmacy education: A systematic review and meta-analysis. BMC Med Educ. 2019;19(1):286. doi: 10.1186/s12909-019-1724-6, PMID 31357986.
33. Galvao Tais F, Silva Marcus T, Neiva Celiane S, Laura M, Ribeiro Mauricio G. Pereira. Problem-based learning in pharmaceutical education: A systematic review and meta-analysis. Sci World J. 2014.
34. Murdiyah S, Suratno S, Nur Ardhan AF. The effect of problem-based learning integrated with concept mapping technique on students' learning activities. JPBI. 2020;6(1, March):39-46. doi: 10.22219/jpbi.v6i1.9113.
35. Fisher RC. The potential for problem-based learning in pharmacy education: A Clinical Therapeutics Course in Diabetes. Am J Pharm Educ. 1994;58(Summer).
36. Dolmans Diana H J MHJM, De Grave Willem, Wolfhagen Ineke H A PHAP, van der Vleuten Cees P MPM. Problem-based learning: Future challenges for educational practice and research. Med Educ. 2005;39(7):732-41. doi: 10.1111/j.1365-2929.2005.02205.x, PMID 15960794.
37. Temasek Centre for PBL [cited 12/4/2022]. Available from: http://www.tp.edu.sg/images/centres/pbl/pbl-framework.jpg.
38. Galvao Tais F, Silva Marcus T, Neiva Celiane S, Ribeiro Laura M, Pereira Mauricio G. Problem-based learning in pharmaceutical education: A systematic review and meta-analysis. Sci World J. 2014;2014:578382, doi: 10.1155/2014/578382, PMID 24701178.
39. Hussain Mumtaz, Sahudin Shariza, Abu Samah Nor Hayati, Anuar Nor Khaizan. Students perception of an industry based approach problem based learning (PBL) and their performance in drug delivery courses. Saudi Pharm J. 2019;27(2):274-82. doi: 10.1016/j.jsps.2018.11.009, PMID 30766440.
40. Arnold-Garza S. The flipped classroom teaching model and its use for information literacy instruction. Comminfolit. 2014;8(1). doi: 10.15760/comminfolit.2014.8.1.161.
41. Harris Bernard F, Janetta Harris, Lora Reed. Maja Zelihic; flipped classroom: another tool for your pedagogy tool box. Dev Bus Simul Exp Learn. 2016;43:325.
42. Moore C, Chung C. Students' Attitudes, Perceptions, and Engagement within a Flipped classroom model as Related to Learning Mathematics. J Stud Educ; ISSN: 2162-6952. 2015;5(3):286-308. doi: 10.5296/jse.v5i3.8131.
43. Sreegiri S, Madhavi D, Kumari L. Student's perception of flipped classroom teaching method in Andhra Medical College, Visakhapatnam. IOSR JDMS e-ISSN [internet]. Vol. 17. p. 6-09.
44. How to flip A classroom – Jonathan Thomas-Palmer https://sites.google.com/site/flippedlearning101/1-getting-started/flipped-classroom-process?overridemobile=true.
45. [cited 12/4/2022]Available from: https://guides.library.utoronto.ca/c.php?g=448614&p=3552449.
46. Shnai I. Systematic review of challenges and gaps in flipped classroom implementation: toward future model enhancement. Proceedings of the europa conference e-learning, ECEL (November):484–90; 2017. p. 2010-Octob.
47. He Yuan, Lu Jun, Huang Huaxing, He Shutong, Ma Nina, *et al* The effects of flipped classrooms on undergraduate pharmaceutical marketing learning: A clustered randomized controlled study. PLOS ONE. 2019;14(4):e0214624. doi: 10.1371/journal.pone.0214624, PMID 30969976.

PICTORIAL ABSTRACT



SUMMARY

In this review article, various challenges faced by pharmaceutical industries to recruit skilled employees and need to improve the situation has been discussed. The advantages, challenges and process of various pedagogical techniques has been listed down. The skill gaps can be bridged by implementing training programs, application of Total quality management and innovation ecosystem in the curriculum. The main focus of this review article is to design a curriculum, develop skill enhancement modules and organize training programs for students to enhance their skills.

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