

REIMAGINING THE ROLE OF CHEMICAL EDUCATION IN DEVELOPMENT OF 21ST CENTURY LEARNING SKILLS WITH REFERENCE TO NATIONAL EDUCATION POLICY 2020

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Abstract:

Transforming the 21st century education is an attempt to change the world and face the upcoming challenges posed by the world. With the change in technology, it is expected to integrate technology in the learning process but the existing classroom process still continues to be by the same traditional method in which there is no opportunity for the learners to engage themselves, so that some learning skills must be developed and implemented in chemical education. National education policy 2020 promotes skills for development of students and for facing the challenges they get in front of them. Those skills include reading skills, research skills, experiential learning and online learning. Chemical education can be improved by changing learning and teaching methods and providing appropriate learning skill. The future belongs to those who know how to use the skills and world will be changed.

Keywords: National education policy 2020, Skills, Chemical Education, Development

“The future belongs to those who learn more skills and combine them in creative ways.”

- Robert Greene

Introduction:

The development of science and technology taking place in 21st century rapidly and hence, the world is growing at faster rate. As a result of this, lot more changes happen and they became challenges. Chemistry is known as central science as it is everywhere in biology, medicine, nanotechnology, physics, etc. Chemistry learning is important in preparing real world and gives opportunity for students with global competence. Only theoretical knowledge is not enough in chemical education, but also experiments, projects, research are parts of chemistry, and these poses challenges.¹ The challenge such as in medicinal chemistry is to find any drug or vaccine for the disease like Covid-19. To overcome these challenges and to survive in 21st century, some skill should be adopted. 21st century chemistry



skill generally focused on Research skills, contemporary issues, (Ethics and Sustainability), professional preparation, and communication skills (oral, written and visual).² 21st centuries is improving in digital world, so to teach digital generation concept of digital game base learning (DGBL). The two approaches are given on these studies (i) student are player (ii) students design the game.³

The chemistry education in 21st century needs skills, values and attitude to acquire competence to thrive in the rapid changing modern world. The skill include life skills (i.e. leadership, flexibility, initiative, social and productivity), besides the literacy skills are information, media and technology. Most important skills are creativity, critical thinking, communication, collaboration, these are the four 'Learning skills', they are not to be only understood but they should be part of every topic in chemistry.⁴ The growing emergence of epidemics and pandemics call for collaborative research and need for multidisciplinary learning. To gain the 21st century learning skills, National education policy 2020 come into force. It gives some guideline to explore the role of chemical education in development of 21st century.

2. Highlights of National Education Policy:

***New pedagogical structure and curricular restructuring of 5+3+3+4.**

- 5 years of foundational stage containing 3 years of pre-primary school and grades 1, 2 in which play-based or activity based or discovery based learning incorporated in children.
- 3 years of preparatory stage consist of grade 3, 4, 5 in which activity based and curricular style of foundational stage, but also gradually incorporate textbook learning as well as formal classroom learning. In this stage student develop learning skills through specialized subjects.
- 3 years of middle stage consist of grade 6, 7, 8. In this stage experiential learning within each subject and exploration of relations among different subjects will encouraged.
- 4 years of High stage contains grade 9,10,11,12. This secondary stage builds on subject oriented pedagogical and curricular style with greater depth, critical thinking and flexibility.
- 3 or 4 years duration of Undergraduate degrees with multiple exit option. After completing 1 year certificate will be given, after 2 years diploma, degree after 3 years and 4 year programme preferred with major and minor research project
- 1 year Master degree for 4 year bachelor degree students and 2 year Master degree for 3 year bachelor degree students. It consists of strong research component to strengthen competence in professional area and to prepare students for research degree.
- Another stage is research stage consist of pursuing high quality research leading to full time or part time 3-4 years of Ph.D.
- It also proposes lifelong learning and research to human beings for knowledge, skills, and experience to lead comfortable life.⁵



3. Reading Skill:

It is one of the four language skills of listening, speaking and writing. To promote widespread reading skill among students reading habit should be developed in every child. For that enjoyable and inspirational books for students at all levels will be developed and made available in both school and local public libraries. Also, to promote e-library or digital library is the best option in this world of digitalization. To promote widespread reading National Book Promotion Policy will be formulated. Initiatives will undertaken to ensure availability, accessibility, quality and readership of books.⁶

4. Research Skill:

Research skills are skills that help you target a goal, gather the appropriate information, and relay it to other people. Research skills are important because they allow you to develop new processes and products and it allows for self-improvement. Some important research skills include goal-setting, data collection, and report writing. National Education Policy 2020 regarding higher education is to develop well-rounded creative and analytic subjects, develop active research, communities, including cross disciplinary research and increase resource efficiency. New National Education Policy 2020 promotes Research-intensive Universities, those that place greater emphasis on teaching and research. This promote research skill among students.⁶

5. Experiential Learning:

Experiential learning in its many forms is widely recognized as a high-impact educational practice, one that has been thoroughly tested and shown to be beneficial to a wide spectrum of college students. Experiential learning is a process through which a learner constructs knowledge, skill, and value from direct experience. The process of learning through experience and is more narrowly defined as learning through reflection on doing. NEP 2020 focuses on “play/ activity based learning” in the foundational and preparative stages and experiential learning in the middle stages. This gives opportunity and potential to the students in the development of their learning and understanding of chemistry. Students will perform simple experiments from fundamental chemistry concepts up to advanced chemistry concepts like acid-base chemistry, chemical reaction through hands-on activities and learn through their experience.⁷

Story telling is one of the best approaches to engage students through listening, reading, imagining, understanding, making and explaining the concepts of chemistry. This will generate interest in students. Story telling is an informal way to learning experience to prevent ‘Chemophobia’.⁸ The learning of chemical bond subjects can be explained by role play method; this will improve critical thinking skill and interest of students in learning chemistry.⁹

6. Online Learning:

21st century is era of digitalization. Due to pandemic of Corona everyone knows how the online education is important; we should be familiar with online learning, teaching skills. For practical purpose there are some journals like Journal of Visualized Experiments (JoVE) that published paper with experimental methods and protocols in video format. There are also several websites which provide ‘Virtual Laboratories’ (PhET, Labster, Chemcollective, Beyond Labz, Praxilabs, etc.) and covers chemistry topics OLABs and VLabs are project



undertaken by Government of India for building virtual labs. SWAYAM or DIKSHA are government funded platforms for teachers and students to gain and share knowledge.⁷ Researchers developed an educational game that uses augmented reality and tangible interaction to teach chemistry to young students. Researchers recently revealed their research findings on the usage and efficiency of the game to promote the learning of chemistry and improve children's perception towards the subject.

Online apps with quizzes, competition, assessments, online communities for share and interest will be developed after getting internet connected smartphones or tablets available in all homes/schools.⁶ For gaining knowledge from all above platform ICT knowledge is must, this comes under technical skills and learning from technology skills should be inculcate.

7. Communication Skill:

It is the most important skill of each and every person whether they may be employee, student, teacher or anyone. If communication skill is good it is easy for a chemistry teacher or guide to teach their students, chemistry concept in easy way. National Education Policy 2020 promotes development of communication and early language, literacy and numeracy from the foundation stage of learning i.e. from early childhood⁶.

8. Critical Thinking Skill:

Every piece of information which is available and its attentive analysis is critical thinking. This skill is needed for chemistry students to problem-solving and in research purpose. Critical thinking in the area of chemistry requires students to not just think about the concepts and principles but also how they can be applied to other areas. National Education Policy 2020 encourages higher order cognitive capacities such as critical thinking⁶.

9. Collaboration Skill:

Collaboration skill, also called collaborative skills, are the skills you use when working with others to produce or create something or achieve a common goal. It is another skill to work in team and understand every teammate. To find solution there is call for collaborative research and if collaboration is good it is easy to find the solution. National Education Policy 2020 promote research collaboration and student exchange between Indian institutions and global institution. This will create interest among students for research in chemistry⁶.

10. Creativity Skill:

Creativity is the ability to think about a task or a problem in a new or different way, or the ability to use the imagination to generate new ideas. Creativity enables you to solve complex problems or find interesting ways to approach task. In order to promote creativity, National Education Policy 2020 gave autonomy to institutions and faculty to innovate on matters of curriculum, pedagogy and assessment within a broad framework of higher education qualifications⁶.

Conclusion:

In the developing world of 21st century there is necessary to develop some skills among each individual. The changing world needs new Policies for that National Education Policy: 2020 has recommended in India and promote skills such as Reading skills, Research Skills, Story-telling, Role play methods and the most important skill of 21st century i.e. online learning skills. These are the essential skill of this era and promoting them by National Education Policy 2020 will definitely helps students in this world of competition.



Experiential learning assist chemistry students to master complex subjects and to gain a deep understanding of fundamental principles that need to applied latter. Success in chemistry in the 21st century requires not only mastery of important chemical concept, but also the skills to apply this knowledge to important societal issues.

References:

- Pazicni, S., & Flynn, A.B. (2019). System Thinking in Chemistry Education: Thereotical Challenges and Opportunities, *Journal of Chemical Education*, 96(12), 2752-2763 DOI: 10.1021/acs.jchemed.9b00416
- Martel-Parrish, A.E., & Lipchok, J.M. (2018). Preparing Chemistry Majors for the 21st Century through a Comprehensive One- Semester Course Focused on professional Preparation, Contemporary Issues, Scientific Communication, and Research Skills. *Journal of Chemical Education*, 95(1), 68-75 DOI: 10.1021/acs.jchemed.7b00439
- Lay, A.N., & Osman, K. (2018). Developing 21st Century Chemistry Learning through Designing Digital Games, *Journal of Education in Science, Environment and Health*, 4(1), 81-92 DOI:10.21891/jeseh.387499
- Bakhshi, A.K., & Rarh, V. (2022). Need to redesign chemistry education in India for the 21st century learning needs. *Accounts of Chemical Education and Research*, 1(1), 1-6
- Kumawat, H., & Sharma, M. (2021). Study of the Indian national education policy 2020 towards achieving its objectives. *Ilkogretim Online- Elementary Education Online*, 20(2), 1050-1055 DOI: 10.17051/ilkonline.2021.02.118
- Ministry of Human Resource Development Government of India. (2020). National Education Policy 2020. <https://www.education.gov.in/>
- Senapati, S., Nagaraja, H.S., & Guru Row, T.N. (2022) Chemical Education and Research in India: Challenges, Perspective, and Future Opportunities in Line with the National Education Policy 2020. *Journal of Chemical Education*, 99, 3678-3686 DOI: <https://doi.org/10.1021/acs.jchemed.2c00454>
- Morais, (2015) C. Storytelling with Chemistry and Related Hands-on Activities: Informal Learning Experience to prevent “Chemophobia” and promote young Children’s Scientific Literacy. *Journal of Chemical Education*, 92(1), 58-65 DOI: [dx.doi.org/10.1021/ed5002416](https://doi.org/10.1021/ed5002416)
- Wahyuni, S. (2020). The effect of role-playing model on Students Critical Thinking Skills and Interest in Learning Chemical Bonds Concept. *Journal of Physics: Conference series* 1460(AICMSTE 2019)1-7, DOI: 10.1088/1742-6596/1460/1/012088

