DIGITALIZATION IN CHEMISTRY EDUCATION WITH REFERENCE TO NATIONAL EDUCATION POLICY 2020

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Abstract:

Digital education helps one learn and understand everything quicker. Most of learners are interested in chemistry education combine with the use of digital technologies. In this study lot of information is given about digital platform, apps, websites, gaming platforms, social media platforms and emphasis on National Education Policy (NEP) 2020 guidelines about digitalization such as pilot studies, digital infrastructure, online teaching platform and tools, virtual labs. This digitalization plays an important role in Chemistry Education. With the popularity of online education and coming up of digital universities in India in the near future, teachers also need to become proficient in development of e-content in four quadrant format and MOOCs/Online courses. Teachers should be aware that digital teaching offers greater potential for orientation towards learners. A critical and important dimension of National Education Policy (NEP) 2020 at all levels of education is digitalization and this process of digitalization gets boosted in the system with the introduction of lifelong learning and flexibility.

Keywords: *- Digitalization, National Education Policy, Learning.*

"We need technology in every classroom and in every student and teachers hands because it is the pen and paper of our time and it is lens through which we experience much of our world"

-David Warlick

Introduction :

Traditional education system definitely plays a vital role in building a personality. Traditional education teaches about manners, law, rule, harmony, humanity, friendship, society, etc. It will make a person good citizen of the country. Traditional education has good number of limitations too as known. The student fails to understand when the teaching is not as per their standard and not in a comfortable place. All the traditional education system focusing on the marks and grades, students do not understand the meaning of the application

of knowledge. Education is a basic need for every learner and digital education is the current trend. Digitalization is the process of transfer of correspondent data over to digital data. The first contemporary use of the term " Digitalization" in conjunction with computerization appeared in 1971 essay first published in the North American Review[1]. Digitalization has been identified as the most important technological trend in both education and society[2]. Now a day's digitalization in education sector is most important thing in the world. The whole word is moving toward the digitalization in education and in many sectors. Chemistry education is the study of teaching and learning chemistry. In 1990s computer technology was use in chemistry education mainly to support teachers in delivering recurring educational activities and is means of transferring traditional teaching and learning activities into the computer[3]. One of the most important things in chemistry education is practical learning and classroom learning. But before the digitalization there were so many challenges in practical learning due to deficiency of lab mechanics, computers and other equipment. But due to digitalization now a day it is easy to learn and perform practical and research.

In National Education Policy (NEP 2020) there is special focus on digitalization of education sector. There is special focus on the virtual labs and digital infrastructure for developing innovative chemistry laboratories and project base learning labs and digital infrastructure required. Also focus on the pilot studies for online education, online teaching platforms and tools. (NEP 2020)[4]. In this paper we have discussed about digitalization in chemistry education and what the tools are, social media platforms, innovative techniques available for students, teachers and researchers to learn chemistry easily.

National Education Policy (NEP) 2020 and Digitalization:

The National Education Policy 2020 recognizes the importance of leveraging the advantages of technology while acknowledging its potential risks and dangers. It calls for carefully designed and appropriately scaled pilot studies to determine how the benefits of online/digital education can be reaped while addressing or mitigating the downsides. In the meantime, the existing digital platforms and ongoing ICT-based educational initiatives must be optimized and expanded to meet the current and future challenges in providing quality education for all. The National Education Policy (NEP) 2020 recommended the following key Initiatives.

[a] Pilot Studies For Online Education :

Appropriate agencies, such as the NETF, CIET, NIOS, IGNOU, IITs, NITs, etc. will be identified to conduct a series of pilot studies, in parallel, to evaluate the benefits of integrating education with online education while mitigating the downsides and also to study related areas, such as, student device addiction, most preferred formats of e-content, etc. The results of these pilot studies will be publicly communicated and used for continuous improvement.

[b] Digital Infrastructure:

There is a need to invest in creation of open, interoperable, evolvable, public digital infrastructure in the education sector that can be used by multiple platforms and point solutions, to solve for India's scale, diversity, complexity and device penetration. This will

ensure that the technology-based solutions do not become outdated with the rapid advances in technology.

[c] Online Teaching Platform and Tools:

Appropriate existing e-learning platforms such as SWAYAM, DIKSHA, will be extended to provide teachers with a structured, user-friendly, rich set of assistive tools for monitoring progress of learners. Tools, such as, two-way video and twoway-audio interface for holding online classes are a real necessity as the present pandemic has shown.

[d] Content Creation, Digital Repository, and Dissemination:

A digital repository of content including creation of coursework, Learning Games and Simulations, Augmented Reality and Virtual Reality will be developed, with a clear public system for ratings by users on effectiveness and quality. For fun based learning student-appropriate tools like apps, gamification of Indian art and culture, in multiple languages, with clear operating instructions, will also be created. A reliable backup mechanism for disseminating e-content to students will be provided.

[E] Addressing the Digital Divide:

Given the fact that there still persists a substantial section of the population whose digital access is highly limited, the existing mass media, such as television, radio, and community radio will be extensively used for telecast and broadcasts. Such educational programmes will be made available 24/7 in different languages to cater to the varying needs of the student population. A special focus on content in all Indian languages will be emphasized and required; digital content will need to reach the teachers and students in their medium of instruction as far as possible.

[F] Virtual Labs:

Existing e-learning platforms such as DIKSHA, SWAYAM and SWAYAMPRABHA will also be leveraged for creating virtual labs so that all students have equal access to quality practical and hands-on experiment-based learning experiences. The possibility of providing adequate access to SEDG students and teachers through suitable digital devices, such as tablets with pre-loaded content, will be considered and developed.

[G] Training and Incentives for Teachers:

Teachers will undergo rigorous training in learner-centric pedagogy and on how to become high-quality online content creators themselves using online teaching platforms and tools. There will be emphasis on the teacher's role in facilitating active student engagement with the content and with each other[4].

Role of Digitalization in Chemistry Education.

The educational context of the twenty-first century is immersed in a society with high consumption of digital media, where students spend between 16 and 21 h on media per day, that is, they spend most of their waking hours using various technologies. In addition,

multimedia is extremely captivating for young people and presents lower infrastructure requirements, transforming them into facilitators of learning processes contextualized in their interests and relating technologies to knowledge. It is combine use of computer hardware, software and educational theory and practice to facilitate learning. Currently in which use of internet, smartphone and tablets are rise in the field of education and research[5]. Education Apps helps students to analyze what they have been taught and what is the source of it which makes them curious to know more but in a systematic way where they know how, when and what to explore. This overall process helps the students to learn practically and not theoretically. There are various apps to help students learn chemistry, from understanding the elements, molecules and atoms to exploring chemical reactions which are listed below.

- Periodic Table 2021 - Chemistry
- Chemistry
- Chemistry Pro 2021 - Notes, Dictionary & Elements
- Periodic Table 2021 PRO - Chemistry
- Chemical Formulas Quiz
- Molecule 3D
- Equate Formula Solver
- Wolfram Alpha
- Chemistry Calculator
- Science Practical Simulator
- Khan Academy
- Starfall Catalyst for Students
- Thermodynamics Calc. Tablet
- Organic Nomenclature
- The Chemical Suite
- Functional groups in chemistry
- Hydrocarbons: chemical structures and formulas
- Elements in Action[6]

Laboratory teachings are turning out to be boring, monotonous and tedious for students. In addition to that, setting up a laboratory is not only expensive for colleges, but maintaining and sustaining it for a long time is equally challenging. Virtual labs provide universities with a useful alternative to traditional labs, as they help students understand abstract concepts clearly by repeatedly practicing them in the virtual environment. Moreover, a virtual lab is cost-efficient and offers a safe workspace, where complicated and dangerous experiments can be simulated easily. A virtual lab is a digital educational environment that uses virtual reality or a PC to create a digital simulation of a real-life laboratory. It introduces controlled, safe and immersive scenarios for students to visualize equipment or conduct experiments individually or in groups. Chemistry is mainly an experimental science. e-Labs as video demonstrations and virtual labs with simulations need to be integrated along with hands-on experiments for better understanding and visualization of what is happening inside the reaction flask or apparatus![7]

Manual graph plotting should be replaced by excel or other graph plotters through which one experiment can be understood in a variety of ways by changing the variables in excel rather than performing the experiment just once as is the usual practice. Practical

Record books can be in fully ICT mode. Real time observations and inputs of various data in experiment can be taken using ICT Tools and calculations can be automated. Integrating use of ICT tools usage in experiments is also environmental friendly and greener. Project based learning is a form of teaching in which learners acquire knowledge through active involvement in real-world and personally relevant projects. Project base learning (PBL) is an inquiry-based learning model in which teachers serve to scaffold and lead students through an extend investigation phase that requires working together to accomplish a chemistry project through use of digital world.[7]

One approach suggested by researchers to educate the digital native generation is digital game-based learning. An innovation has been initiated to take advantage of the student as game designer approach to support the acquisition of chemical concepts and 21st century skills as well as increase students motivation in chemistry. A module known as Malaysia Kimia (Chemistry) Digital Game, MyKimDG, has been developed in order to assist students in the learning of the Salt chapter and achieve the desired goals. The findings suggested that learning through MyKimDG was more effective than the conventional method at supporting a higher achievement in the Salt chapter, 21st century skills and motivation in chemistry. The inclusion of student as game designer approach in chemistry learning is able to increase student's achievement and motivation in chemistry as well as their 21st century skills[8].

Open-access, online educational platforms launched in the last decade are receiving growing attention from both academia and the general public. A special class of such courseware known as MOOCs (massive open online courses) allows enrollment of up to hundreds of thousands of students from all over the world. A massive open online course (MOOC) or an open online course is an online course aimed at unlimited participation and open access via the Web. In addition to traditional course materials, such as filmed lectures, readings, and problem sets, many MOOCs provide interactive courses with user forums or social media discussions to support community interactions among students, professors, and teaching assistants (TAs), as well as immediate feedback to quick quizzes and assignments. The very first chemistry MOOC was launched by edX in the fall of 2012. The course Introduction to Solid State Chemistry, which is based on a core MIT 3.091 course, was started on October 9, 2012 and lasted until January 2013. The course was taught by Michael Cima of MIT. So far it is the only chemistry course offered through the edX platform. This course was among the five launching courses that started edX. The first chemistry MOOC offered by Coursera was Introductory Organic Chemistry I, which started in January 2013. The course was taught by Jeffrey S. Moore and Nicholas Llewellyn, both at University of Illinois at Urbana−Champaign (UIUC). The course is designed for eight weeks and covers the basics of organic chemistry: stereochemistry, orbitals and their interactions, substitution and elimination reactions, and so forth. Assessment materials consist of multiple-choice quizzes administered weekly (15−20 questions) and open-response questions in which students practice drawing chemical structures and reaction mechanisms (30 attempts allowed). MOOC Research Initiative recently launched by the Bill and Melinda Gates Foundation is another way of facilitating the research in this area. MOOCs represent a promising educational technology, currently developing at a very fast pace. To evaluate the efficiency and impact of MOOCs, extensive educational research is necessary in the future[9].

Moodle is free software, a learning management system providing a platform for e-learning and it helps the various educators considerably in conceptualizing the various courses, course structures and curriculum thus facilitating interaction with online students. Lesson of Moodle is an interesting, flexible and interactive way to show the students different topics of a chemistry subject, where they read some content, and after that, they have to answer some questions. Based on the answers the student gives, the system sends him/her to another page in the Lesson[10]. Social media platforms are also useful to learn chemistry easily and interestingly. Social media can be used to enhance students and staff interaction and provides an alternative learning technique from the traditional whiteboard lecture approach. Such social media platform includes.

- Social networking sites - Facebook or Tweeter
- You tube, Instagram, Tiktok
- Creation of republishing tools – Wikipedia, blogs and many more

Digital Skills in Chemistry Teachers:

Digital skills in teachers refer to the development or improvement of pedagogical tasks through digital technologies, for which the concept of digital pedagogical competence considers the constant use of the attitudes, knowledge, and skills required to organize, conduct, evaluate, and revise a continuous method of learning through ICT, based on theory, recent research, and experience that supports possible student learning. The main task of chemistry teachers is teaching and supporting the learning of learners. Therefore chemistry teachers should have skills for using digital media to support individual, self-managed and collaborative formats; they should also be able to design their digital teaching so that media help the learners in completing joint task, in interacting and in joint knowledge generation within and beyond lessons[11].

Consequences of Digitalization:

Digitalization has extremely positive outcomes but the negative outcomes are also equally impacting the system. With the change in the process of gaining knowledge, there will be great change in the extent of the knowledge and also the effectiveness of the knowledge. If the whole of the education is digitalized then the usage of the knowledge will not be very impactful and will not be reaching the targeted space because it will be more like communication between machines and less like the knowledge transfer. More increasingly the digitalization is going to occupy the process of enrolments, designing of curriculum, pedagogy, and evaluation, and subsequently, it will transform the educational development and knowledge gaining process of individuals who are in the formal system of education. This is very important for the quality of life of individuals in the contexts of social, cultural, and economic elements of human life of the future India

Conclusion:

In the traditional educational system, we were mostly dependent on the textbook or teacher`s speech. Digital education has opened up a world of opportunities for students and teachers alike. With the advent of online classes, students can now access education from anywhere; at any time**.** The contribution of digital thchnologies in chemistry education is very

much helpful for next generation student. Chemistry software for structure drawing, 3D visualization, molecular modelling, in-silico reactions, drug designing, etc. need to be integrated in the teaching methodology as well a part of curriculum to prepare the future chemists. A balance between digital technology and social interaction is key to maximizing all the opportunities and minimizing the limitations that digital technology brings to children and their education, whether knowledge-based or practice-based. Digital media can help to lessons more accessible and inclusive, they can be used for individualization and differentiation of teaching and learning.

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