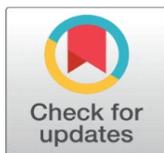
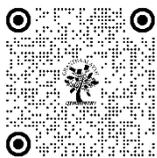


# THE NATIONAL EDUCATION POLICY (NEP) 2020 OF INDIA ADDRESSES THE ROLE OF SCIENCE EDUCATION

Dr. Poonam<sup>1</sup>✉, Dr. Indu Ravish<sup>2</sup>✉

<sup>1</sup>Dr. B.R.A. Govt. College Jagdishpura, Kaithal

<sup>2</sup>Dr. B.R.A. Govt. College Jagdishpura, Kaithal



## ABSTRACT

NEP 2020 places a strong emphasis on the professional development of science teachers to improve teaching methodologies and subject expertise. This includes regular training programs, workshops, and opportunities for teachers to engage with the latest developments in their field. The policy also encourages the use of innovative teaching methods and technologies to make science education more engaging and effective.

The policy aims to cultivate a research mind set among students through project-based learning and exposure to scientific methodologies. This approach encourages students to ask questions, formulate hypotheses, conduct experiments, and draw conclusions based on evidence. By engaging in research projects from an early age, students develop critical thinking skills and a deeper understanding of the scientific process.

### Corresponding Author

Dr. Poonam, [lohanpoonam@gmail.com](mailto:lohanpoonam@gmail.com)

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## 1. INTRODUCTION

The National Education Policy (NEP) 2020 in India represents a significant shift in the country's approach to education, with a strong emphasis on science education as a cornerstone of the overall educational framework. This comprehensive policy aims to revolutionize the way science is taught and learned across all levels of education, from primary to higher education. The key aspects of science education under NEP 2020 are designed to create a more engaging, relevant, and effective learning experience for students while preparing them for the challenges of the 21st century. The NEP 2020 strongly advocates for the integration of science with other subjects to promote holistic learning and understanding of real-world applications. This approach recognizes that scientific concepts are not isolated but interconnected with various fields such as mathematics, social sciences, and humanities. By breaking down the traditional subject silos, students can develop a more comprehensive understanding of how scientific principles apply to diverse areas of knowledge and real-life situations. For example, environmental science can be integrated with geography and economics to provide a more nuanced understanding of climate change and its socio-

economic impacts. The policy places a significant emphasis on hands-on experiments, observations, and practical applications to develop scientific thinking and inquiry skills. This approach moves away from rote learning and theoretical knowledge to a more immersive and engaging learning experience. Students are encouraged to learn by doing, which helps them develop critical thinking skills, problem-solving abilities, and a deeper understanding of scientific concepts. This could involve conducting experiments in laboratories, field trips to observe natural phenomena, or designing and building simple machines to understand physical principles. Recognizing the growing importance of digital literacy and computational skills in the modern world, the NEP 2020 introduces coding and computational thinking from middle school onwards. This initiative aims to enhance problem-solving abilities and prepare students for a technology-driven future. By learning to code, students develop logical thinking, algorithmic problem-solving skills, and the ability to break down complex problems into manageable parts. These skills are not only crucial for future careers in technology but also applicable across various scientific disciplines. The policy removes rigid subject stream distinctions, allowing students to choose science subjects alongside arts or humanities. This flexibility enables students to pursue interdisciplinary studies and explore their diverse interests without being confined to traditional subject boundaries. For instance, a student interested in both biology and psychology can now study these subjects together, opening up new avenues for research and career opportunities in fields like cognitive science or neuroscience. NEP 2020 recognizes the importance of building a strong foundation in science from an early age. It focuses on strengthening basic science concepts in the early years of education to build a robust foundation for advanced learning. This approach ensures that students have a solid grasp of fundamental scientific principles before moving on to more complex topics. For example, introducing basic concepts of physics, such as force and motion, in primary classes can help students better understand advanced topics like mechanics in higher classes. The policy emphasizes the incorporation of traditional Indian scientific knowledge and practices into the curriculum. This approach aims to create a sense of pride in India's scientific heritage while also exploring the relevance of ancient knowledge in modern contexts. For instance, the study of Ayurveda can be integrated with modern biology and chemistry, providing students with a holistic understanding of medicinal practices and encouraging research in this field. Science education under NEP 2020 is designed to develop critical thinking, creativity, and innovation. These skills are essential for success in the rapidly evolving global economy. The policy encourages project-based learning, collaborative problem-solving, and the application of scientific knowledge to real-world challenges. This approach prepares students not just for careers in science and technology but also equips them with transferable skills valuable in any profession. The policy mandates regular revision of science curricula to include cutting-edge developments and emerging fields. This ensures that students are exposed to the latest scientific advancements and are prepared for future challenges. For example, topics like artificial intelligence, genomics, and nanotechnology are being introduced at appropriate levels to keep the curriculum relevant and forward-looking.

NEP 2020 places a strong emphasis on the professional development of science teachers to improve teaching methodologies and subject expertise. This includes regular training programs, workshops, and opportunities for teachers to engage with the latest developments in their field. The policy also encourages the use of innovative teaching methods and technologies to make science education more engaging and effective.

The policy aims to cultivate a research mind set among students through project-based learning and exposure to scientific methodologies. This approach encourages students to ask questions, formulate hypotheses, conduct experiments, and draw conclusions based on evidence. By engaging in research projects from an early age, students develop critical thinking skills and a deeper understanding of the scientific process.

NEP 2020 integrates environmental education and sustainability concepts within science curricula. This approach aims to create environmentally conscious citizens who understand the scientific basis of environmental issues and can contribute to sustainable development. Topics such as climate change, biodiversity conservation, and renewable energy are woven into the science curriculum at various levels. The policy emphasizes leveraging digital tools and resources to enhance science learning experiences. This includes the use of virtual laboratories, simulation software, and online resources to supplement traditional classroom learning. Technology integration also enables personalized learning experiences, allowing students to progress at their own pace and explore topics of interest in greater depth. NEP 2020 shifts towards competency-based assessment rather than rote learning in science subjects. This approach

focuses on evaluating students' ability to apply scientific concepts, analyze data, and solve problems rather than merely recalling facts. The policy encourages continuous and comprehensive evaluation, including practical assessments, project work, and application-based questions. By reimagining science education, the policy seeks to create a generation of scientifically literate citizens capable of driving innovation and addressing complex global challenges. The implementation of these reforms is expected to significantly enhance the quality of science education in India, potentially positioning the country as a global leader in scientific research and technological innovation in the coming decades.

Many recommendations concerning subjects and values to be promoted are provided by the NCF 2005. The section that follows from the NCF2005 discusses the purpose of science education. In light of students' varied learning stages, the framework also recommends modifying science curricula. In response to the wonder and awe of nature, humans have, according to NCF 2005, created and used new tools to interact with nature, carefully observed the physical and biological environment, looked for any relevant patterns or relationships, and created conceptual models to make sense of the world. The result of human endeavor is the modern sciences. Observation, the search for patterns and regularities, the formulation of hypotheses, the development of mathematical or qualitative models, the deduction of their implications, the verification or falsification of theories through controlled experiments and observations, and the ultimate discovery of the principles, theories, and laws governing the natural world are all generally included the scientific method. A progressive, forward-thinking society views science as a dynamic, constantly-expanding body of knowledge that explores ever-new areas of experience. Perhaps science can help people escape the cycle of ignorance, poverty, and superstition. This could be a truly liberating function of science. In terms of the child, life, and science, excellent science education is authentic.

## **2. SCIENCE EDUCATION**

The NCF 2005 offers a number of recommendations about topics and the ideals that should be promoted. The goal of science education is addressed in the section from the NCF 2005 that follows. The framework also suggests modifications to science curricula based on the various learning stages of students. According to NCF 2005, one important way that humans have responded to the wonder and awe of nature since the beginning of time is to attentively examine the physical and biological environment, search for any relevant patterns or relationships, create and employ new tools to engage with nature, and construct conceptual models to make sense of the world. The modern sciences are the result of human endeavour. In general, the scientific method entails a number of connected steps, including observation, the search for patterns and regularities, the formulation of hypotheses, the creation of mathematical or qualitative models, the deduction of their implications, the verification or falsification of theories through observations and controlled experiments, and the eventual discovery of the principles, theories, and laws governing the natural world. In a progressive, forward-thinking society, science is a dynamic, ever-expanding body of knowledge that covers ever-new realms of experience. Science may play a truly liberating function, assisting people in breaking free from the vicious cycle of poverty, ignorance, and superstition. A quality science education is authentic to the child, to life and to science.

## **3. AIMS OF SCIENCE EDUCATION**

Following immediately from the six criteria of validity-cognitive, content, process, historical, environmental, and ethical - are the overarching goals of science education. To summarize, science education should enable the learner to.

1. Know the facts and principles of science and its applications, consistent with the stage of cognitive development
2. Learn the methods and procedures that contribute to the creation and confirmation of scientific knowledge.
3. Develop a historical and developmental perspective of science and to enable her to view science as a social enterprise
4. Relate to the environment (natural environment and people), local as well as global, and appreciate the issues at the interface of science, technology and society.
5. Nurture the natural curiosity, aesthetic sense and creativity in science and technology, imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment
6. Cultivate 'scientific temper'-objectivity, critical thinking and freedom from fear and prejudice. Source of modern science. In a progressive, forward thinking culture, science is a dynamic, ever-expanding body of knowledge that

covers ever-new fields of experience. In the fight against ignorance, superstition, and poverty, science can be a really liberating force.

The scientific method comprises several interrelated stages, including observation, pattern recognition, hypothesis development, and qualitative research design. "By 2022, curriculum and pedagogy will be modified to reduce rote learning and promote holistic development and 21st century abilities like critical thinking, creativity, and scientific temper, communication, collaboration, multilingualism, problem solving, ethics, social responsibility, and digital literacy [1]. This is the recommended goal for curriculum and pedagogy transformation.

In order to accomplish the goals, the committee has made multiple suggestions. The sections that follow are mostly based on the NEP 2020's guidelines for science education. Through doing, students will learn. During this process, the learner watches, considers, analyses, and draws a judgement. These abilities will be put to use as they create new innovations and technologies. India will produce a more informed and scientifically and technologically literate population in the future, which will make India a happier nation. The two essential components of educational processes are recommendations and implementations [2, 3].

**REPHRASING THE SYLLABUS:** The curricula will be based on significant depth, greater critical thinking, attention to life objectives, flexibility, and student choice, as well as a subject-oriented pedagogical and curricular approach. Though there will be some required common subjects for all students, there will be a great deal of leeway in choosing elective courses, such as those in the arts, vocational training, and physical education, based on individual interests and skills. Context and motivation will come first, followed by analysis, discussion, and application.

**MODULAR BOARD EXAMINATIONS:** To determine the common courses, a modular board examination system that solely evaluates fundamental ideas, principles, critical thinking, and other higher-order skills in each subject will be redesigned. For the remaining classes, a lot of flexibility will be provided. Pupils could select any combination of disciplines that piqued their attention. Giving students the freedom to select their own courses is a progressive and much-needed notion, as it will be the only way to maximize their productivity.

**FLEXIBILITY AND VOCATIONAL LEARNING:** Traditional, highly theoretical learning methods would be replaced by vocational education. The skills required to work as electricians, carpenters, and plumbers will be taught to the students. All students must learn and achieve in any curriculum, regardless of background, as these professions are despised in India. Students' range of motion will be one inch.

**INTERDISCIPLINARY APPROACH:** In addition to studying the social sciences and sciences, all students will have the chance to participate fully in the arts and humanities. Higher education will also discourage such a division.

#### 4. INCORPORATION OF VOCATIONAL IN TO ACADEMIC STREAMS

The primary and secondary education curricula will guarantee that there won't be a rigid division of the academic and vocational streams because every student will have the chance to develop both types of abilities. Given how quickly the economy is changing, basic abilities are now even more crucial than specialised knowledge. Every child will acquire at least one vocational skill throughout middle and high school, according to the NEP. Vocational education is therefore going to be incorporated across the value chain. By 2025, the goal is to expose 50% of students in K - 12 and postsecondary education to vocational skills.

**EDTECH PLAYERS/ITI/POLYTECHNICS TO COLLABORATE WITH SCHOOLS:** There will be a chance for Edtech companies' to work with educational institutions to provide skill-building programmes with a certain level of independence. Short term certificate programmes may be offered, and new, interdisciplinary courses that complement ODL and online delivery methods will be mandated. Working with secondary schools will provide ITIs and Polytechnics with greater mobilisation opportunities, which will aid in addressing issues connected to awareness and perception.

**LEARNING SCIENCE IN REGIONAL LANGUAGE:** Students whose medium of instruction is the local/home language will begin to learn science bilingually in Grade 8 or earlier, so that by the end they can speak about science both in their home language and English. This will help the students to understand scientific concepts in a better way,

and enable future scientists to talk about their work and about science to their families and to local news channels, write about their work for regional newspapers, and to help inspire the next generation.

Science Education at Higher Level

**TO CREATE INTEREST IN SCIENCE AND INCULCATE SCIENTIFIC TEMPER:** To encourage undergraduate and graduate students majoring in engineering, medicine, and fundamental sciences to pursue careers in research. However, the current formal education structure does not support the exploratory approach to science and school system does not always address diversity issues. Careers in science continue to be enticing to young brains. Language barriers, gender inequality, a widening rural-urban divide, a lack of basic resources, and poor curriculum development are some of the main barriers to promoting diversity in education. NEP aims to understand the intricate connections between scientific education, culture, and socioeconomic status in order to create cutting-edge, inclusive teaching strategies that will captivate every student.

**INTEGRATION OF VOCATIONAL EDUCATION WITH HIGHER EDUCATION:** While degree programs such as Bachelor of Vocation will continue. With improved linkages between formal education and vocational education the B. Voc. Programme is likely to gain popularity, especially the ones that are employment oriented and co-developed with industry leaders. Increased market orientation of vocational education will solve the problem of unemployment.

## 5. SKILL GAP ANALYSIS AND MAPPING OF LOCAL OPPORTUNITIES

Through engagement with industry at several levels, including co-developed courses and the establishment of incubation centres at HEIs, the NEP aims to concentrate on creating industry links and demand-driven vocational courses. In addition, the policy calls for conformity to international norms. Vocational education focus areas are supposed to be selected by a combination of mapping local opportunities and skill gap research. Under the National Higher Education Qualification Framework (NHEQF), vocational education will be introduced as an additional career pathway. There will be opportunities for corporate involvement in research, joint delivery of short-term skill certificates, and joint establishment of online institutions.

**INCREASED NUMBER OF QUALITY TRAINED INSTRUCTORS:** The National Curriculum Framework for Teacher Education (NCFTE) will be included in teacher education curricula for vocational education. This is expected to increase the quality and number of trained trainers.

Opportunity for Players Operating in Assisted

**TECHNOLOGY:** Assistive devices, technology-based supportive tools and language-appropriate teaching-learning materials will be made available to assist especially abled students to integrate more easily into classrooms. Implementation of this technology will help promote inclusivity and is also expected to provide opportunity to players in the assisted technology space

**DIGITALIZATION OF EDUCATION/USE OF ICT TOOLS:** NEP weaves the digital thread across the very fabric of the education system resulting in digitalization of education. Technology adoption resonates across all facets of education in the new policy be it for online learning, e-program delivery, teacher training or e-assessments.

**INTERNATIONALIZATION OF EDUCATION:** The NEP seeks to transform learners into 'truly global citizens', new content needs to be developed keeping in mind the larger learning goals around environmental awareness, resource conservation and other global concerns. It will also pave the way for global employment Opportunity.

Indian students' exposure to the world through exchange programmes and the establishment of foreign university branch campuses in India: International universities will have the chance to open campuses in India and work with Indian higher education institutions. Their Universities will receive autonomy equivalent to that of other independent Indian universities, and a legislative framework supporting their admission will be established. It would be a fantastic opportunity to strengthen ties with Indian educational institutions in order to give teachers and students more exposure to the global community and raise standards of instruction [4].

## 6. CONCLUSION

Education Policy 2020's recommendations are carried out with the same dedication, they could serve as a corner stone for the nation's and its citizens' overall development. They would also assist students in learning and developing the skills that will enable them to adjust to a variety of circumstances. Providing multiple exit and entry points,

emphasising learning outcomes and pedagogical innovations, developing autonomous science institutions, international collaboration, redesigning board exams to assess conceptual clarity, developing scientific temper, interdisciplinary approach, making science education value-based, restructuring science curriculum in accordance with global standards, curriculum flexibility, and emphasising creativity and innovations are some of these recommendations. The importance of science curricula in fostering the development of diverse life skills is expressed in NEP 2020, which is concerned with science education. By working together, HEIs and skill providers - ITIs, Polytechnics, and Industries - will be able to design programmes specifically for HEIs and play a part in reshaping the higher education landscape to better suit the demands of the labour market. Through resource optimisation measures, courses developed in partnership with HEIs will aid in the development of meaningful, employment-oriented offers at reasonable costs. Future issues were taken into consideration when developing policies and suggestions, as the world continues to provide numerous obstacles to individuals, societies, countries, and even the world at large. It is necessary to embrace change and adjust to the constantly shifting circumstances. At the grassroots level, this can be accomplished through the advancement of science and technology while retaining industry as a prerequisite. The world presents many problems to individuals. Policies and recommendations have been developed with an eye towards potential future challenges and with the goal of equipping learners to meet those challenges. Changing education for the twenty-first century is an effort to confront the difficulties of the globalised world and make a difference in it. If correctly integrated and applied with the same intention and spirit, the dynamic recommendations given by both policies can work wonders in assisting learners in learning and acquiring these skills, which in turn aids in their ability to adapt to various situations. The expression "survival of the fittest," which has its roots in Darwinian evolutionary theory, is particularly relevant when discussing how to survive in a world that is changing. He made the accurate statement that the species that is most adaptable to change survives rather than the strongest or smartest. Therefore, one must embrace change and adjust to the circumstances. Only education, the most potent weapon available, can in still this value.

## **CONFLICT OF INTERESTS**

None.

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None.

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