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PROGRAMMES AND POLICIES IN SCIENCE EDUCATION: AN OVERVIEW

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ABSTRACT

National programmes and educational policies play vast and important role in science education to find, fill and uplift the areas that need to be giving more focus and reconstructed and greater attention by adopting Information, Communication and Technology (ICT) in the science education. Previous and present education policies also put forth the major objectives of science education. In this paper discuss the different policies like, education policy 1968, 1986, policy national education policy on Information communication and Technology-2012 and its role in science education. Further, discussed the role, importance and effectiveness of draft National Education policy (DNEP)- 2019 in Science Education. With credibility and role of policy in science education through ICT policy 2012, Learning Outcomes(LOs) and NISTHA there are some major challenges and issues which need attention at the grass root level in all the Organizations, educational institutions, which is also discussed.

KEYWORDS: DNEP, Nistha, Learning Outcomes, NCF.

1. INTRODUCTION:

Science is the intellectual and practical discipline encompassing the systematic study of the structure and behaviour of the physical and natural environment through observation, experiments, and formulation of a hypothesis, testable explanations, and predictions. Good science education is the need in the all-around environment of human life. Science is also accelerating the growth of the national economy, cooperation in the sustainable development of all sectors. Science engaged students in composite learning and discipline with working in hands knowledge to design more advanced technological modules in the general and career life following with practical activities and analyses on issues concerning the environment and health. Teaching and learning science are linked to the teacher's, learners and their medium of dissemination of science instructions under different characteristics of educational systems. These include the availability of resources and quality of textbooks, the appropriateness of the assessment system, the availability of laboratories and scientific equipment, the school environment in which learning takes place, and the quality of the science teacher.

A panel on Science Education in Secondary Schools was set up in May 1964 by the Planning Commission under the Chairmanship of Prof. M.S. Thacker. The panel was broad-based and composite representing State Governments, Education Boards, Ministry of Education, Council of Scientific and Industrial Research, National Buildings Organization, Indian Standards Institute, and Independent Scientists. The panel examined the procedure for the allotment of funds and procurement of equipment in secondary schools and thereafter drew standard lists of equipment for science laboratories, and suggested grants for the purpose. Commission recommended that the lists of equipment for physics, chemistry and biology laboratories of high schools be prepared on the basis of the syllabi of Maharashtra and U.P. Boards and indicate generally the minimum equipment that a high school should have with necessary modifications to suit requirements of the syllabus. The essential items of apparatus, equipment, and apparatus should be supplied immediately when science is introduced in class IX. Boards of Secondary Education should introduce a system of evaluation of student's practical laboratory work. Students should be encouraged to make simple scientific instruments themselves since it will give them a practical bias to learn science at the secondary school stage.

Constitute a separate branch of Science Education in each State Department of Education for improvement of science teaching. Emphasis on education system setup Kothari Commission (1964-66), focused on the situation of school laboratories. During in-depth study found weak feature in the schooling system of teaching and laboratory work, where the approach on emphasis should shift to the location of a problem, the development of hypotheses and the designing of procedures and experiments relating to theory. The expenditure on laboratories will have to be stepped up considerably. Laboratory- cum-lecture rooms in the schools with to keep specimens, models and charts with the necessary facilities, advanced level study course facilitate to talented students with staff and laboratory. Demonstration experiments and laboratory investigations should reflect the agricultural and industrial interests of the local community. This would make science teaching more realistic for the pupils and also more interesting and useful. Special laboratory work for the practical education of the properties and peculiarities of materials should be conduct, costly equipment sharing by schools in a given neighbourhood to minimize the cost and increasing contribution in teaching-learning Well-planned visits may be arranged to laboratories, museums and other places During the five to six-week summer vacation programme special facilities of the laboratory should be focused and involved.

After four decades, Government of India set up the National Curriculum Framework to address the issues in teaching-learning environment to the uplift education system, National Curriculum Framework (NCF-2005) address that absence of laboratories appropriate facilities drastically narrow subject options for children, denying them equal opportunities for learning and future life chances and emphasizes on laboratories in schools, particularly those in rural areas, are poorly equipped with science labs activities. Hence, important that resources are made should available for well-equipped laboratories and adequate facilities in schools. Further, considering the importance of laboratories at the secondary stage, CABE Committee Report on Universalisation of Secondary Education (USE) in 2005 in given norms for physical infrastructure includes one laboratory each in physics, chemistry and biology for secondary school. Further sub-Group set up on Secondary and Vocational Education for XI five year plans clearly expressed the need for laboratories and workshops to promote experimental culture while reducing the importance of external examination. Further, Rashtriya Madhyamik Shiksha Abhiyan (RMSA) was launched in 2009 by the Govt. of India. It includes framework with the provision of integrated laboratory in secondary school and also makes provisions for science equipment's, science kits, science exhibitions, etc. to popularize and strengthen science education.

2. NATIONAL EDUCATION POLICIES AND ITS VISION OF SCIENCE EDUCATION:

2.1 National education policy 1968:

National education policy advocates that a radical reconstruction of education is essential for economic and cultural development of the nation, for national integration and for realising the ideal of a socialistic pattern of society. For a continuous effort to expand education opportunity, a sustained and an intensive effort to raise the quality of education at all stages. An emphasis on the development of science and technology and the cultivation of social and moral values.Further says that science education and research is the integral part for the development of schooling education with a view to accelerating the growth of the national economy, science education and research should receive high priority. After two decades of 1968 policy new education policy reframed in 1986 with elaboration of science education is discuss in next section.

2.2 National policy 1986 & modified in 1992:

Secondary education begins to expose students to the differentiated roles of science, the humanities and social sciences. This is also an appropriate stage to provide children with a sense of history and national perspective and give them opportunities to understand their constitutional duties and rights as citizens. Access to secondary education will be widened with emphasis on enrolment of girls, SCs and STs, particularly in science subject following with other subject's commerce and vocational streams. Boards of Secondary Education will be reorganised and vested with autonomy so that their ability to improve the quality of secondary education is enhanced. Effort will be made to provide computer literacy in as many secondary level institutions as possible so that the children are equipped with necessary computer skills to be effective in the emerging technological world. In the school curricula, in addition to laying down a common scheme of studies for boys and girls, science education were incorporated as compulsory subjects and work experience assigned a place of importance.

A major effort will be directed towards the transformation of teaching methods.

Audio-visual aids and electronic equipment will be introduced; development .of science and technology curricula and material, research, and teacher orientation will receive attention. This will require preparation of teachers at the beginning of the service as well as continuing education thereafter. Similarly, the services of specialists with academic qualifications in the humanities, social sciences, sciences, etc. will continue to be required in various job positions.

The anticipated scenario by the turn of the century, with specific reference to the likely changes in the economy, social environment, production and management processes, the rapid expansion of knowledge and the great advances in science and technology. Science education will be strengthened so as to develop in the child well defined abilities and values such as the spirit of Inquiry, creativity, objectivity, the courage to question, and an aesthetic sensibility.

Science education programmes will be designed to enable the learner to acquire problem solving and decision making skills and to discover the relationship of science with health, agriculture, industry and other aspects of daily life. Every effort will be made to extend science education to the vast numbers who have remained outside the pale of formal education.

The network of institutions set up from time to time since Independence to facilitate the application of science and technology would need to be substantially and expeditiously updated, since they are fast becoming obsolete

2.3 National policy on Information Communication and Technology-(2012):

To make education qualitative and inclusive, the government introduced a policy on ICT in all aspects of science education in more depth in teaching and learning order to uplift and transform the scope of classrooms to e-classrooms, rich in audio-video, demonstrations and access to the internet including mass group. For example, teaching-learning through virtual reality and augmented reality, online laboratory, Artificial intelligence (AI) for divyang learners. After four decades in 2019, the National Policy on education came into existence for the public domain.

2.4 National Policy on Education-2019:

The National Education Policy 2019 envisions an India-centred education system that contributes directly to transforming our nation sustainably into an equitable and vibrant knowledge society, by providing high quality education to all. Schooling education system is the grass roots for the holistic aspect of all human knowledge and enquiry as fundamentally connected. The present policy focused on such an approach that integrate Science and Technology have showed positive learning outcomes.

2.4.1 New curricular and pedagogical structure for school education:

Present and future education needs with respect to employment and beyond, together with advances and discoveries in cognitive science, have also made clear that a new structure for the educational system is required in order to deliver the vision of science education enunciated in this Policy and to prepare our students optimally in the 21st century.

2.4.2 Restructuring curriculum and pedagogy:

The curricular and pedagogical structure of school education will be reconfigure to make them responsive and relevant to the developmental needs and interests of learners at different stages of their development, therefore education should be guided by proposed 5+3+3+4 design.

- Foundational Stage, flexible, multilevel, play-based, activity-based, and discovery-based learning, continuously incorporating the latest research in ECCE as well as the various time tested Indian traditions for cognitive and emotional stimulation of children.
- Preparatory Stage, the general groundwork across subjects, including, science so that students are prepared to delve deeper into learning areas through specialised subjects and subject teachers.
- Middle Stage, required group activities for learning science. Experiential learning within each subject, and explorations of relations among different subjects, will be encouraged and emphasised despite the introduction of more specialised subjects and subject teachers.
- Secondary stage, knowledge build on the subject-oriented pedagogical and curricular style with greater depth, greater critical thinking, greater attention to life aspirations, and more flexibility and student choice with digital literacy and scientific temper, languages, and communication skills. Students should be given flexibility and choice of subjects to study across the science

2.4.3 Integration arts and sciences:

All students will have the opportunity to engage deeply in the arts and humanities as well as in the study of the sciences and social sciences.

2.4.4 Learning science bilingually:

language is one of the most important barriers to understanding and learning science and different subjects. Therefore, the medium of instruction is that the mother tongue or regional language can begin to find out science bilingually in upper primary or earlier in order that by the secondary stage they will talk and discuss the science each in their local language and English. this teaching-learning processes modify students regarding, belief, on the subject. In addition, integration of technology and modify future scientists to speak about their work and about science to their families and to the native environment up to next generation.

2.4.5 Sanskrit and knowledge of its extensive literature:

Worldwide, Sanskrit is that the basic and vital language that spoke itself an excellent written repository of data referring to various subjects as well as science. Sanskrit has competed for an excellent role within the Indian tradition of the search for science data, in addition, because the cultural unity of the country, facilities for the study of Sanskrit, its scientific nature, and as well as samplings of numerous ancient and medieval writings in Sanskrit from a various set of writers.

2.4.6 Incorporation of communication in Science:

At the middle and secondary stages, communication among the students should be one's peers with the aim to discuss more sophisticated and course- specific topics viz., during science class, students may be asked to explain a creative solution to a problem at the board, or in ethics class, explain their own perspective on an ethical dilemma on real life basis. Students will also formally learn to talk about social, scientific technological, agricultural, medical, and environmental problems facing India and the world. These aspects would naturally have important implications for students' future contributions to the country and to the global community.

2.4.7 Establishment of topic-centered and project-based clubs:

A system of Topic-centered and Project-based Clubs and Circles in Science, and other subjects will be set up and funded in accordance with student needs in various localities, in order to foster singular interests and talents of students across the country.

2.4.8 Physical infrastructure, facilities, and learning resources:

To provide adequate education for students at various stages, it's necessary schools will be provided with adequate physical infrastructure, facilities, and learning resources(classroom boards, vibrant school libraries, equipment for use in science experiments and laboratories, material for arts/crafts and vocational training classes, computer rooms, as well as suitable classrooms with adequate furniture), either individually or within their school complex. State governments will review all schools against clearly stated norms for essential facilities and safe and attractive learning environments and achieve them by 2022. Funding will be allocated by the Centre and State governments on apriority basis for the design, development, and maintenance of infra-structure and resources that are effective and conducive to learning.

2.5 Effect of National Education Policy 1986 : Implemented National Curriculum Framework-2005:

This simple observation leads to the following basic criteria of validity of a science curriculum:

I. Cognitive validity requires that the content, process, language and pedagogical practices of the curriculum are age appropriate, and within the cognitive reach of the child.

II. Content validity requires that the curriculum must convey significant and correct scientific information. Simplification of content, which is necessary for adapting the curriculum to the cognitive level of the learner, must not be so trivialised as to convey something basically flawed and/or meaningless.

III. Process validity requires that the curriculum should engage the learner in acquiring the methods and processes that lead to the generation and validation of scientific knowledge and nurture the natural curiosity and creativity of the child in science. Process validity is an important criterion since it helps the student in 'learning to learn' science

IV. Historical validity requires that the science curriculum be informed by a historical perspective, enabling the learner to appreciate how the concepts of science evolve over time. It also helps the learner to view science as a social enterprise and to understand how social factors influence the development of science

V. Environmental validity requires that science be placed in the wider context of the learner's environment, local and global, enabling him/her to appreciate the issues at the interface of science, technology and society, and equipping him/her with the requisite knowledge and skills to enter the world of work.

VI. Ethical validity requires that the curriculum promote the values of honesty, objectivity, cooperation, and freedom from fear and prejudice, and inculcate in the learner a concern for life and preservation of the envi-

ronment.

2.6 Learning Outcomes (LOs) at the Secondary Stage:

Leads to change in the attitude, perception, competencies, observations of teachers, teacher-educator, students and parents and that need to accomplish the task at various levels. With this perspective, the NCERT developed the Learning Outcomes in the academic year 2017 for the elementary stage addressing the concerns of Right of Children to Free and Compulsory Education (RTE), 2009 on the learning levels of children. NCERT had also initiated discussions with various stakeholders, as well as the capacity building of teachers. As a follow up of this, the states and UTs had taken an initiative to disseminate learning outcomes in their schools. It is in this context, that the demand for learning outcomes for the secondary stage from the different school education boards, SCERTs, etc. increased. These changes were observed and short out the problems by NCERT at Secondary level . In this year 2019 draft document of Learning outcomes developed and posted on NCERT official website. Before uploaded the final document in public domain, suggestions were invited at States, Union Territory and National levels from individual to different Organizations and final document is available on the official website of NCERT with the document name Learning Outcomes at Secondary Stage. The very process of learning which leads to development Addressing this demand, the NCERT has developed the Learning Outcomes for the Secondary Stage in all subject areas in school education. This document contains the different nine subjects viz., Hindi, English Language, Mathematics, Science, Social Science, Urdu, Sanskrit, Health & Physical Science and Art Education in both Hindi and English version. Education in the entire document, provide pedagogical content knowledge processes that match the learning needs of students. Adequate space has been given to national and social concerns such as gender, inclusion, constitutional values, protection of environment, and children with special needs in the learning outcomes. Moreover, the 21st century skills of problem solving, critical thinking, creativity, etc., are also an integral part. Besides, these learning outcomes have strong linkages with Sustainable Development Goals-4 with regards to the concern of universal quality education.

2.6.1 Learning Outcomes (LOS) of Science:

Science is the outcome of human endeavour to build conceptual models to understand the world. It is a dynamic, expanding body of knowledge, covering newer domains of experience everyday. (NCERT-LOs)

Presently, the developed Learning Outcomes at the Secondary stage focus on the various scientific and pedagogical content knowledge through interconnected processes of principals, theories, experiments, observations, formulated hypotheses, and devising qualitative. According to the NCF-2005, Science is being taken as one of the core subjects in the secondary school curriculum. The NCERT has taken in account the all possibilities beyond the expectation of just complete the syllabus given in the textbooks of Science at IX and X standard. At this state, the Learning outcomes emerge into three discipline physics biology and chemistry. The expectation of this document is to exposed to experiences, process skills, critical thinking of problem solving as well as enhance the thought process across the disciplinary boundaries and outcomes of real knowledge. explanations, thinking critically to consider, and evaluate alternative explanation, etc. A wide range of strategies and activities is given for teaching learning processes to meet curricular expectations at secondary stage, the Science learning outcomes organized into two parallel phase which is called Pedagogical processes and Learning Outcomes.

2.7 National Initiative for School Heads' and Teachers' Holistic Advancement (NISHTHA):

NCERT also developed a National level document that contained module on different subjects for capability building programme to "Improving Quality of school Education through Integrated Teacher Training" which is called as National Initiative for school Heads and teachers holistic advancement. Competencies always an important area in teaching-learning processes. Therefore, this document aims to create competencies among teachers and principals at the elementary stage. The functionaries (at the state, district, block, cluster level) shall be trained in associate degree integrated manner on learning outcomes, facilities at primarily based assessment, learner – centred pedagogy, new initiatives in education, addressing the need and requirement of student through multiple pedagogies, etc.

This programme mainly organized by constituting National Resource teams (NRGs) and State Resource teams (SRGs) at the National and the State level two lakhs academics afterwards. A strong portal/Management system (MIS) for delivery of the training to teachers and heads of the schools, observance and support mechanism presently will be infused with this capability building initiative in Indian education system. There are following expected outcomes of NISHTHA are (1) enabling and enriching inclusive classroom environment for healthy education environment, (2) developing a stress-free School-Based Assessment focused on the development of learning competencies, (3) integration of ICT in teaching-learning processes and assessment, (4) teachers will adopt activity based to move enhance competency-based learning, (5) awareness of new initiatives in school education to develop and strengthen the personal-social qualities of students for their holistic development, (7) to use Art as pedagogy leading to increased creativity and innovation among students. (8) teachers become alert and responsive to the social, emotional, and psychological needs of students as first-level counsellors and (9) transformation of the Heads of Schools into providing academic and administrative leadership for the schools for fostering new initiatives. Following with other module, also developed training module on pedagogy of science i.e., basic understanding of science as a subject at upper primary stage and curricular expectations and learning outcomes at upper primary stage, applying science as a process of inquiry and knowledge construction, explain how teacher can facilitate learning of science, integrate content, pedagogy and assessment during teaching-learning process and design various learning situations for students to transact concepts

2.8 Conclusion:

Visibility of problems and challenging issues in school infrastructure, research, development and training programmes in science education. Productive initiatives taken by the government to uplift the level of science education through various programmes and policies were introduced to identify the gap areas in science education. It provides a clear picture of gap areas that are needed to meet through the integration of innovative science practice, scientific, theoretical and practical understanding and knowledge among different stakeholders. As the trend of education uplift simultaneously, the need for science education increase in a different dimension to achieve sustainable development. In the present scenario, to accomplish the goals of science education need critical thinking on access, use and implementation of science and technology with the traditional method of teaching for different stakeholders viz., teachers, teacher-educators and students. Skilled human efforts, budget allocation, knowledge attainment through the hands-on practice of science with the assistive items in daily use and locally available should be an essential part of science education.

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