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ALLIGNING STEM EDUCATION WITH NEP2020

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The key thrust of NEP2020 is to shift the education system from the present system of rote learning towards real understanding and learning how to learn. It also aims among others to build well rounded individuals equipped with 21st century skills. In order to revamp and reorient all the aspects of the curricular structure and pedagogy, NCFSE(2023)[National curricular framework for school education 2023] has been developed which is based on the recommendations done in the NEP2020. According to the NCFSE2023,teaching and learning should be conducted in a fun loving manner making classrooms more fun, creative, collaborative and has exploratory activities for students for deeper and more experiential learning. This objective of the NEP2020 is very challenging as it is quite contrary to the present system of Education which is based on lecture method and is teacher centric. Therefore it is imperative to construct a new pedagogy which is in line with these objectives of the NEP2020.STEM education which is an integration of **Science Technology Engineering And Mathematics** aims to teach with an altogether different pedagogy where learning and teaching is done by hands on activities by using specially designs kits or toys or using unconventional settings used in our daily life,also called the tinkering method. The students are at the centre stage whereas the teachers play the role of facilitators This is made easy by setting up tinkering labs in the classrooms.This sytem of teaching creates an altogether different environment in the classroom and makes schools a much friendlier place for students. The teachers play the role of observers and students are the centre stage doing the activities by little help from the teachers. In this article the author will discuss the recommendations made in the NEP2020 , NCFSE 23 for science education and and their effectiveness in the promotion of STEM education.

KEY words: STEM education,NEP2020,NCFSE 2023,Tinkering Labs,21st century skills

STEM EDUCATION

In order to create a suitable and sustainable society in the 21st century it requires preparation from an early age through teaching and learning which is inseparable from the role of the teacher who can determine the approach used, the learning model used, and the method used. To improve the quality of learning, teachers can use several approaches in accordance with the progress of the age (21st century) .One approach that is now widely used by various countries in the world is the STEM approach.

STEM is an acronym of the integration of science (S), technology (T), engineering (E) and mathematics (M). STEM is a combination of various approaches that have been adopted from different disciplines, which involve single or multi-disciplinary contributions to one activity. As Stem pedagogy is student-centered active learning,it helps remove language barriers and can improve long-term knowledge retention and deep understanding. However,certain barriers such as lack of knowledge about STEM, limited Knowhow about integration of technology in education,student readiness,lack of infrastructure make it difficult to Implement STEM education in classes.

ATAL TINKERING LABS and STEM EDUCATION

In India, the Atal Innovation Mission, represents a significant effort to embed STEM education within the national framework. Launched in 2016, the Atal Innovation Mission (AIM) is a flagship program aimed at fostering innovation and entrepreneurship across various sectors. It includes several initiatives, such as Atal Tinkering Labs (ATLs), Atal Incubation Centres, New India Challenge programs, Atal Research and Innovation for Small Enterprises (ARISE) Centres, and Atal Community Innovation Centres (ACIC).(1) ATLs are innovation workspaces in schools designed to provide K-12 students with access to do-it-yourself kits and IT equipment. These labs aim to promote a practical learning approach, encouraging students to explore and innovate. As of the latest data, over 10,000 ATLs have been established across 35 states and union territories, engaging more than 1.1 crore students and 6,200 mentors of change. Despite the success in creating numerous projects, startups, and patents, following challenges remain in terms of reaching all schools and ensuring consistent quality across different regions.

1. The number of ATLs is insufficient compared to the total number of schools. For instance, in Rajasthan, only 400 out of 70,961 schools have ATLs. (2)
2. A significant gap exists between the existing educational levels of students and the skills required for effective tinkering.(3)
3. Variability in teacher quality and engagement, coupled with high workloads and lack of incentives, affects the program's effectiveness.(4)
4. The infrastructure and language of instruction limit the program's reach and effectiveness.(5)
5. AIM's funding cut-off after five years poses a risk of discontinuation for some labs, particularly in rural areas.(6)

NEP2020

In order to improve STEM literacy, STEM-focused curriculum has been extended to many countries beyond the United States, with programs developed in places such as Australia, China, France, South Korea, Taiwan, and the United Kingdom. (7)The National Education Policy 2020 is a policy to aid the progress of STEM training in India. It emphasises integrating Science, Technology, Engineering and Mathematics (STEM) education into the curriculum to foster students' critical thinking, problem solving skills etc. The strategies used for STEM learning closely align with guidelines used by the new education policy 2020.For example,one of the goals of NEP2020 is to shift the education system from the present system of rote learning towards real understanding and learning how to learn. It also aims among others to build well rounded individuals equipped with 21st century skills.(8)The NCFSE standards are intended to teach the application of concepts to real-world contexts. When using the STEM learning approach, education becomes more personally meaningful and takes advantage of students' natural curiosity. This approach prepares students for the future by having students communicate, collaborate and try new approaches in finding solutions to real-world problems. Middle school is an appropriate age to develop an interest in science that will persist through secondary school, into college and beyond into a career. Providing authentic, active learning experiences contributes to the internalization of learning about science.(9)

RECOMMENDED PEDAGOGICAL APPROACHES AND SETTINGS FOR TEACHING OF SCIENCE SUBJECTS

In order to achieve the learning outcomes as set in NEP2020 for science education,it is recommended to make certain changes in the teaching pedagogy of science. The teaching of science subjects should be based on hands on activities, enquiry,demonstrations and linked with actual problems which we face in our daily life for example waste management in the urban areas, educating healthy life styles for improving our health, sustainable

life styles and at the same time helping the young minds to explore innovative ideas to come up with solutions rather than just studying about the problems. Instead of teaching biocomposting the copies, they can be encouraged to make biocompost dustbins at homes, green houses out of waste materials, weighing their food in terms of nutritive values, calorie requirements and availability of different types of foods in different ecological conditions, identifying the fingerprints etc.

RESOURCES IN SCIENCE TEACHING

NEP2020 has suggested that in the middle stage ,if schools can use science kits and can provide dedicated lab space, with adequate space for simple materials and resources, it must be done. At the same time, doing Science must not be restricted to Science laboratories or Science kits. Classrooms, especially in the Middle Stage, must allow the doing of Science. At the same time, all safety considerations must be kept in mind. Tinkering laboratories which are informal spaces where students can 'play' with simple scientific materials and equipment independently – can be set up in any room within the school. This will help students strengthen design thinking, creating, and experimental capacities. Initially, students would have to be supported by the Teacher.

ASSESSMENT

Although practical are given due weight age but needs significant improvement for validity and objectivity. **Vocational Education**, Art Education, and Physical Education and Well-being are an integral part of the curriculum in this NCFSE. However, in this case, much of the assessment will have to be demonstration-based and not written-exam based. It is recommended that **75% of weightage** in overall certification be given to such demonstration-based assessment, and only 25% to any written examination. Science and other subjects also need to have demonstration-based assessment, e.g., conducting experiments. This should have 20-25% weightage in the overall certification of the subject. This kind of assessment currently happens but needs significant improvement for validity and objectivity. The exams will focus more upon the competency based assessments rather than rote learning assessments.

CONCLUSIONS

In India, a large number of tinkering labs have been set up in selected goverment schools in order to help the students learn about robotics AI and coding.. One of the major focuses for NEP is to change the current education system of rote learning to evidence based and hands-on learning. Thus,NEP recognises and sets a path for a multi-disciplinary approach to education which is philosophically aligned to STEM learning.(10) However,the teachers are not well trained in this type of teaching method and a disconnect at this level can do more harm than good as it will create an environment of indiscipline in the class. It is therefore required to train the teachers with this type of pedagogy at a robust level.Thus Simultaneous use of STEM education and mixed learning is required to achieve the goals of NEP 2020 and make the model more sustainable. (11)

To increase the intensity and quality of STEM implementation in schools, collaboration from several parties including schools, government and universities are needed. Training needs to be held so that teachers become more familiar with STEM so that teachers can prepare STEM well. Collaboration from universities needs to be done so that studies can be carried out on the implementation of STEM in accordance with its nature and how to improve the quality of STEM learning in schools. Improving the STEM workforce is a top priority for policy makers, practitioners and researchers with the need to recruit and retain more students to work in STEM-related fields compete with the global competition and most importantly improve STEM literacy for all students

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