

**REVITALIZING MATHEMATICS EDUCATION THROUGH THE LENS OF DESIGN THINKING**
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**Abstract**

*The knowledge landscape is changing quickly across the world. Many unskilled jobs globally may be replaced by machines due to a variety of dramatic scientific and technological advancements, including the emergence of big data, machine learning, and artificial intelligence. Consequently, there will be an increasing demand for a skilled workforce, particularly in the fields of mathematics, computer science, and data science, as well as multidisciplinary skills across the social sciences, humanities, and sciences. It is more crucial than ever for students to not only learn, but also learn how to learn, given the rapidly evolving global environment and job landscape. Therefore, education needs to focus more on teaching students how to think critically, solve issues, be creative and interdisciplinary, and innovate.*

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*In order to make education more immersive, inquiry-driven, learner-centered, discussion-based, adaptable, and most importantly pleasurable, pedagogy must be reformed. The National Education Policy (NEP 2020) is a significant step in that direction which is based on the idea that both foundational capacities of literacy and numeracy and higher-order cognitive abilities, such as critical thinking and problem solving must be developed through education. In order to fulfil the global demands of the 21st-century employment and entrepreneurship, NEP recognized the value of mathematical reasoning. Modern technologies and global trends, such as blockchains, artificial intelligence, machine learning, and big data analytics are all based on mathematics. Therefore, it is essential to develop our students' computational thinking skills by employing experiential techniques to make mathematics interesting and fun from the school level.*

*The researcher of the study believes that Design Thinking is a process that fosters and encourages critical thinking and problem-solving abilities. In this same vein, the researcher through this study explores the effectiveness of implementing the Design Thinking approach in teaching Mathematics in Secondary schools. The research study involves development of a training program on Design Thinking for the Secondary School Mathematics Teachers. An extensive 9-week training program designed to assist instructors in comprehending the principles of Design Thinking, coming up with innovative lesson plans, and recognizing the difficulties associated with incorporating Design Thinking into their instruction. The purpose of the research study is to determine how well this program meets these goals.*

**Introduction:**

**New Education Policy (NEP 2020) and Critical Thinking:** The development of each individual's

creative potential is given special attention in the New Education Policy (NEP 2020). It is based on the idea that cognitive abilities, both the "foundational

capacities" of literacy and numeracy and "higher-order" cognitive abilities, such as critical thinking and problem solving must be developed through education. The new education policy calls for the curricular integration of essential subjects, skills, and capacities. To this end, focused pedagogical and curricular initiatives will be implemented at all levels of education, including the introduction of modern subjects like artificial intelligence, design thinking, holistic health, organic living, environmental education, and global citizenship education at appropriate points.

It is acknowledged that mathematics and mathematical thinking will play a major part in India's future and in the country's leadership in the many emerging industries and professions that will include data science, machine learning, artificial intelligence, and other related subjects. As a result, during the academic years, beginning with the foundational level, an increased emphasis will be placed on mathematics and computational thinking using a range of creative techniques, such as the frequent use of games and puzzles that enhance and captivate mathematical thinking.

The purpose of assessment in our educational system will change from being summative and focused primarily on testing rote memorization skills to being more regular, formative, competency-based, and focused on learning and development for students. It will also test higher-order skills like conceptual clarity, analysis, and critical thinking.

As a result, this policy aims to change both the quantity and quality of research conducted in India through a comprehensive approach. This entails significant changes in the way that education is taught in schools, with a focus on scientific method and critical thinking, and greater emphasis on play and discovery-based learning.

**Significance of Mathematics Teaching in NEP 2020:**

Due to the wide range of applications for mathematics, NEP gives students flexibility in applying their knowledge by implementing an interdisciplinary curriculum and a credit-based system. The 2020 National Education Policy (NEP) offers a wealth of provisions and a framework for developing, cultivating, fostering, encouraging, and multiplying mathematical thinking. In order to strike a balance between the demands of 21st-century employment and entrepreneurship which is characterized by critical, lateral, and quantitative thinking, it has implemented the necessary modifications. The NEP recognized the value of mathematical reasoning and its requirement for the nation to achieve vishwaguru status. Modern technologies such as blockchains, artificial intelligence, machine learning, and big data analytics are all based on mathematics.

Therefore, it is essential to develop our students' computational thinking skills. By employing cutting-edge techniques to make mathematics interesting and fun from the very first step, the NEP supplies the required sustenance. Additionally, NEP requires middle schools to implement a coding curriculum since it fosters the development of computational skills and intuitive reasoning.

**Need for Implementing Design Thinking in Mathematics Teaching:** In the majority of secondary schools, teacher-centered methods are still used to teach mathematics. This approach, which aims to instill a mathematical understanding in the students' minds without going into great detail about the steps involved in reasoning, analyzing, assessing, and drawing conclusions, might occasionally entail memorization and repetition of previously taught content. Additionally, some students may find it challenging to apply the knowledge they have learned to answer mathematical problems in novel situations, which means that these processes may not develop critical thinking skills in them. Developing the students'

thinking skills ought to be one of the main goals in encouraging creativity in them.

The ability to calculate is as old as humanity, and one of the skills we utilize on a daily basis to overcome obstacles to survival is critical thinking. People have to make decisions on a regular basis that require them to reason, comprehend, interpret, analyze, and evaluate the information in front of them. Critical thinking is required for this process because it helps people make accurate and trustworthy decisions, behave morally, and adjust to changes in their surroundings. Due to the complexity of the concept and the need for both cognitive and emotive abilities, some teachers have found it difficult to teach students about critical thinking. Additionally, it seems that some educators struggle to integrate the idea into their lessons so that students can develop critical thinking skills in addition to what to think. As a result, students struggle to understand the material and score poorly on math tests and exams.

### **Research Study: Implementation of Design Thinking in Secondary School Mathematics Education**

The research study involves development of a training module based on Design Thinking for the Secondary School Mathematics Teachers. A comprehensive 9-week training program to help the teachers understand the concepts of Design Thinking, plan their lessons creatively and understand the challenges in implementing design thinking in their teaching. Without comprehending the patterns, students learn and retain concepts by rote. There needs to be a shift in the methods used to teach, assess, and evaluate math. The goal of this study is to educate educators on the value of design thinking in the classroom. Techniques for encouraging thought, ideation, and prototyping must be included in the instructional plans. The research aims at studying the effectiveness of this programme in meeting the above objectives.

The researcher of this study aims to provide teachers with training on the design thinking process so they can recognize their obligation to act as change agents in the fields of teaching and learning. They don't have to be flawless or possess all the answers, but they do need to be open to trying new things, have the courage to have great dreams, and exercise patience while experimenting with the various designs that come to them. They might be empowered and equipped with the means to effect real change in education thanks to design thinking.

Following the training, educators can conduct student interviews to reconsider their teaching strategies and create new curriculum by ideation and unit prototyping. Because teachers have received training on how to employ human-centered design principles to better understand their students, students are more involved in the evolving learning environment. The most significant shift, real change motivated by the requirements of the students rather than the demands of the education department is made possible by the fact that teachers are now taking a more hands-on approach to designing their own learning environments. This development also elevates the profession of teaching.

By applying creativity, design thinking helps educators to see that creating a learning environment that is truly effective requires deliberate and thoughtful work. If we want to enhance education and learning to make it more relevant, efficient, and enjoyable for everybody concerned, teachers must be the entrepreneurial designers and re-designers of school "systems" and schools themselves.

The training module will work to provide new opportunities for instructors to be intentional and collaborative when they are creating new solutions for their classes, schools, and communities. It enhances their skills and equips them with the capacity to create workable solutions. In this module, the researcher has provided a set of steps that can help them come up with

innovative, creative solutions that prioritize individuals.

Teachers will learn about the design thinking process and resources from this study, enabling them to approach and resolve challenges more deliberately. These approaches have been utilized for decades by companies, social entrepreneurs, and other innovators to create solutions for a range of issues. Teachers and instructors are already designing on a daily basis, whether it be by coming up with new and more efficient ways to teach a subject, repurposing our classroom space, creating new avenues for communication with parents, or creating new school solutions. The study's tactics are adapted to teachers' requirements and let them work within the constraints that they already have. The research aims to inspire educators to approach problems in a different way and discover how Design Thinking can help them see things in a different light.

**Understanding Design Thinking Process:** Design Thinking is a human-centered, iterative process which provides a solution-based approach to solving problems. As per Stanford d.school, Design Thinking involves the following five steps:

**Step 1: Empathize** – It involves investing time to learn about people, their motivations, emotional and physical needs, worldview, and things that are important to them.

**Step 2: Define** - It involves the culmination of all the data collected in order to develop a meaningful, actionable problem statement or point of view.

**Step 3: Ideate** - It involves exploration of possible solutions through brainstorming, allowing to think out of the box and providing the idea to build a possible solution.

**Step 4: Prototype** – It involves transforming the idea into a tangible representation or possible solution that can be tested and validated.

**Step 5: Test** – It involves trying out the prototype and gaining feedback which can be used to enhance the prototype, learn more about the user, and improve the original point of view.

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