Dream, dream, dream….

Dreams Transform into Thoughts and Thoughts Result in Action- Dr A. P. J. Abdul Kalam

" मैं भी बनूँ कलाम "

Main Bhi Banu Kalam

A program to develop an ecosystem for inculcation of innovation in future young scientists, innovators and entrepreneurs

Conceptualization by Vigyan Bharati Rajasthan

Email: sec.vibharajasthan@gmail.com

Programme Background

India is the second-most populous country, the seventh-largest country by area, and the most populous democracy in the world. As society or a nation whenever we get into trouble we invested in to education which determine technology, design, art, engineering and scientific knowledge. Our society has aspiration that our young generation should lead to our society through their problem solving educational knowledge where they should observe, understand, analyze, interpret find solutions, and perform applications that lead to a holistic understanding of the local problems.

The purpose of the education is not to serve the public, the purpose of the education is to create a public. We should also need to develop our future innovators, entrepreneurs, scientist and leaders those who can make thing better with new solutions for our community.

As our great former President **Dr. A P J Abdul Kalam quoted that "*Educationists should build the capacities of the spirit of inquiry, creativity, entrepreneurial and moral leadership among students and become their role model.*"**

Today India is also co-partner of the Global development in the various sector and we should also develop our youth as change agent of the innovation and sustainable solutions for the challenges faced by mankind. ***Main Bhi Banu Kalam*** *Program* will develop a platform for our young kids those have basic creative sense, original ideas and think out of box for developing technical solutions and creating societal impacts.

Introduction - *Main Bhi Banu Kalam* Programme(MBBK)

The simple meaning of the scientific thinking of the great scientist Shri Abdul Kalam was that he wanted an infinite vision to develop the infinite possibilities hidden within every child of the country.

Vigyan Bharati is bringing up the innovation inculcation program "*Main Bhi Banu Kalam*", this program will be **organizedat various levels** to provide the platform for developing and promoting and connecting innovation at grass root level problem and transforming knowledge into action. This activity **will also promote the experimentation, learning through hands-on experiences, learning from failures, and inventions in school level children**.

This program will create new social and cultural worlds – worlds that help students learn by integrating thinking, social interaction, and technology, all in service of doing things they care about. Computers and other technologies have already changed the way students learn. Integrating technology and social issues with into education has the potential to create new and more powerful ways to learn in schools, communities and innovative workplaces. This program **will also bring together young students, kids, technology institutions, innovative organizations in a collaborative way of knowing, ways of doing, ways of being, and ways of caring** about surrounding environment through knowledge and creative ideas.

Objectives of MBBK

1. MBBK aims for **nourishing the Roots** - The STI policy of Government of India has made emphasis on ensuring sustainable pipeline of talented youth for science. Empowering stakeholders for local actions is a key element. The MBBK framework will further enable school science education for early attraction of talent to science. MBBK will devise to inculcate research mentality at school level and develop young leaders in science and engineering in future.
2. MBBK programme is aspiring **to make innovation as epicenter of education** in order to achieve the cultural & attitudinal shift and to ensure that 'Innovation and Startup' culture becomes the primary fulcrum of our education system.
3. MBBK will **help students become innovative and creative** and to help India become leader in sustainable technologies by scouting, spawning and sustaining innovations done by students who left formal education system after 12th class
4. MBBK would **build linkage between formal scientific education systems and informal knowledge systems and create a knowledge network** to link various stakeholders through application of Information Technology and other means.
5. MBBK would develop innovation and creativity, bring together transdisciplinary/ multidisciplinary knowledge and address an authentic problem for students in a surrounding environment.
6. MBBK would integrate all innovation programmes being implemented across country at one platform for students to identify original ideas, innovations, knowledge structuring for entrepreneurship development and local social eco environment system.
7. MBBK will also perform to grow, accelerate and support to all parallel programs running for the science, technology, engineering and mathematics based innovation programs for young students.

Objectivity- Need analysis

A. Need to develop innovation and creativity at early stage -

Our education system builds intellectual culture and the economic circumstances which is completely based upon focusing development over various sector of industries. In the last hundred years' industrialization was focus with low costing production, technological advancement and the market. But Global scenario has been changed in 21st century era where connectivity, communication, open source technology leading us. Now a day even we cannot assume about fast changing economic circumstances and the socio-economic structure.

Telephone- Camera -Wireless-Pager- Mobile- Internet- Free Technology(open source)-Free Knowledge, we have lots of examples of the technological changes those not only develop **new product requirements** but also lead the societal and economical changes. These diversification changes are also creating challenges for knowledge upgradation, skilling and development process of society. MBBK would aspire to cater this challenge at school level.

We need to develop our upcoming young generation as per these 21st century learning requirements so that they can lead our intellectual and economic circumstances through innovation, creativity and divergent thinking abilities. Our young generation must able to understand the changes in the global circumstances and have adaptability for creativity and economic diversification.

This program will bring together educationist, technological knowledge partners and young kids for innovation projects of developing original ideas that have value or ability to finding out lots of possible ways /solution of the local social issues.

B. Need to bring together transdisciplinary/ multidisciplinary knowledge-

Most great learning happens in groups, that knowledge collaboration is the stuff of growth. businesses. If we will look at latest technological development around us in the various sectors **IBM**, as you know, **HP**, Sun, some of the fiercest competitors in the IT world are open sourcing their software, are providing portfolios of patents for the commons.

Eli Lilly, the fiercely competitive pharmaceutical world, has created a market for solutions for pharmaceutical problems. **Toyota**, instead of treating its suppliers as a marketplace, treats them as a network and trains them to produce better, even though they are also training them to produce better for their competitors. Various electronics and mobile companies like **Samsung** are giving knowledge to their sales partners in the market. Now none of these companies are doing this out of altruism; they're doing it because they're learning that a certain kind of sharing is in their self-interest. **Open source** production has shown us that world-class software, like **Linux and Mozilla**, can be created with neither the bureaucratic structure of the firm nor the incentives of the marketplace as we've known them. **Google** enriches itself by enriching thousands of bloggers through **AdSense**. **Amazon** has opened its Application Programming Interface to 60,000 developers. We have other best examples of knowledge sharing, **Wikipedia** has used thousands of volunteers to create a free encyclopedia with a million and a half articles in 200 languages in just a couple of years. We've seen that **ThinkCycle** (started by 2 Indian Co-founders) has enabled NGOs in developing countries to put up problems to be solved by design students around the world.

These are some of the key indication how the new markets are developing and the technology changing the world in the collaborative manner through knowledge sharing.

MBBK will use **collaborative knowledge sharing network** approach. This **umbrella approach**will be involving all joint intellectual effort by individuals(Teacher/Students), tech labs, SME, Socio-economic change leaders integrating and knowledge sharing for ideation and

finding out the possible solutions/answers. We will be **adopting open source approach** for structuring online environment (active and constructive) for each project development process from ideation to prototype development/solution building. This program will also integrate young kids' participation in transdisciplinary manner where they can make connections withmultiple disciplinary knowledge so that they can construct their own meaning and transfer learning to real world environment and supported by the passionate(personal) learning network also.

C. Need to address an authentic problem for students in a surrounding environment

Educational outcomes in traditional settings focus on how many answers a student knows. With MBBK we want students to learn how to develop a critical stance with their work thorough inquiring, editing, thinking flexibly and learning from another person's perspective. Invention and problem-solving aren't just for laboratory thinkers hunkered down, away from the classroom. Students from elementary to high school can wonder about problem, design, and invent a real product that solves real problems. Problem-solving involves finding answers to questions and solutions for undesired effects.

MBBK would revolve around the design process (DP) — an organized, open-ended approach to investigation that promotes creativity, invention, and prototype design, along with testing and analysis. Design project that brings together engineers, designers, academics, and professionals from a variety of disciplines.

Modus operandi of Main Bhi Banu Kalam & stake holders

MBBK will be the platform to develop the original idea which comes from inside and going out as "out of box thinking". MBBK will provide the environment for experiencing learning through experimentation where young students and kids may behave like environmentalist, entrepreneur, scientist or engineer and play new role in the society with new identity.

School leadership will be important for participation and implementation support. The MBBK team will demonstrate that how technology provide us with powerful new tools that can support great teaching learning experience and it will all also support to the conceptual and applied knowledge of STEAM subjects. Program will be running in all across India to identify knowledge structure and original ideas among our young kids. The program will provide support, content and online environment in maximum possible languages of our nation. This program will include the rural, town and city base kids. The students will be participating in this program on the basis of their own knowledge and interest level showing through explain problem/idea/empathy about the surrounding environment, demonstrate deep understanding level and creativity level.

Teachers will be our key role player in this project but first of we need to develop understanding with the school and teachers regarding MBBK. Technology can never replace good teaching or

teacher's understating how best to engage their students, and yet technology provide us with powerful new tools that can support great teaching as one element of the overall design process.

The Government of India has also setup the Atal Tinkering Lab (ATL) in the all across India to create scientific temper and cultivate the spirit of innovations at school level. ATL is a workspace where young mind can give shape to their ideas through hand-on do-it-yourself mode and learn innovation skills. The program will also involve the ATL SCHOOLSall across India.

The orientation program will be also focus on real-world issues and problems - address real social, economic, and environmental problems and seek solutions. See Real World STEAM Problems for some suggestions for projects students might focus on.

A team will be formed for each project which will be guided about the design thinking process and computational thinking process. Team will study about surrounding environment and empathize problems. It will be able to define local problems, conduct background research, develop multiple ideas for sustainable solutions, develop and create a prototype and then test, evaluate, and redesign them.

This sounds like a little scientific method—but during the project, teams of students would try their own research-based ideas, take different approaches, make mistakes, accept and learn from them, and try again. The focus of team will be on developing sustainable, economically viable and large scale solutions.

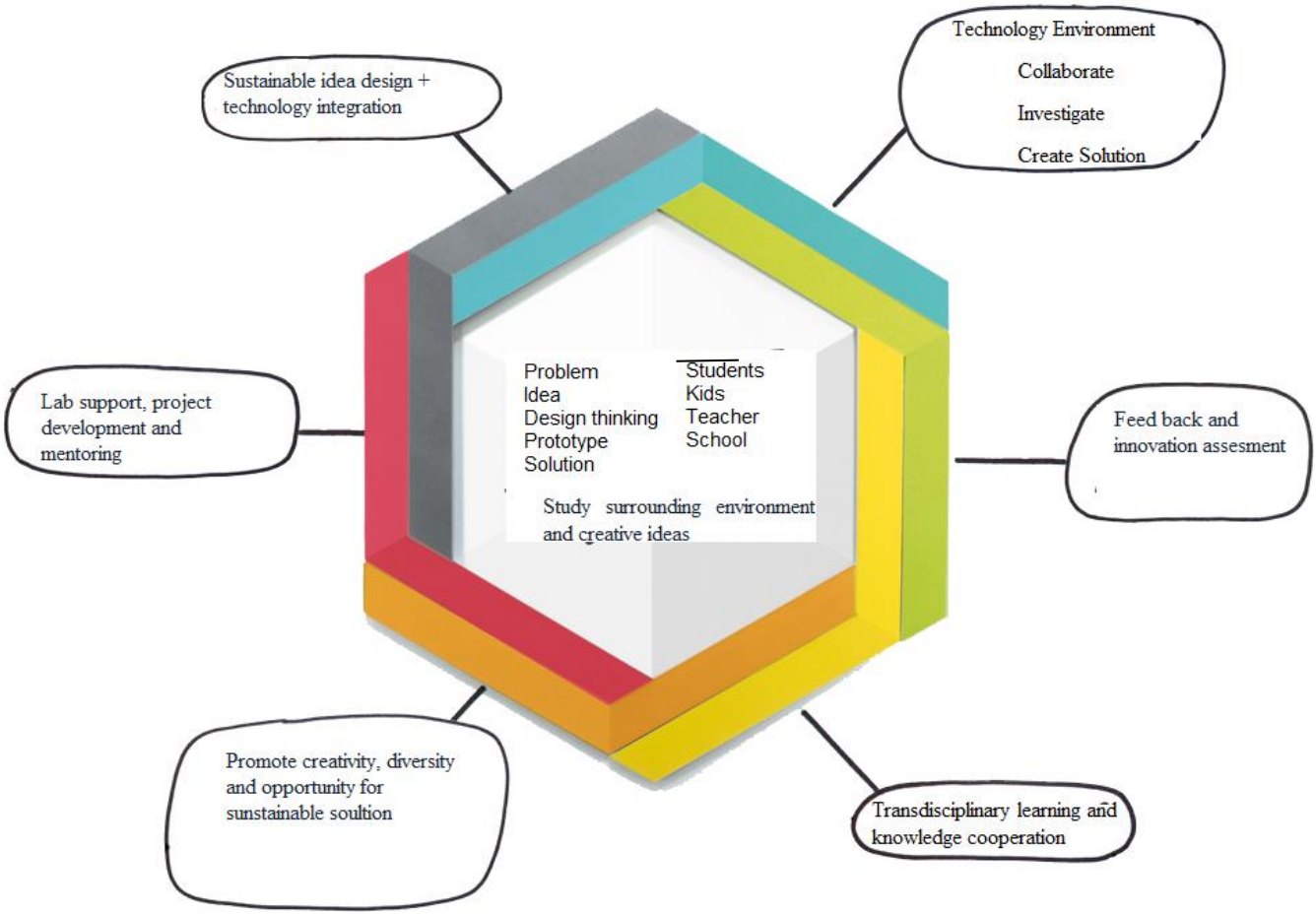
Students' team will be immersed in hands-on inquiry and open-ended exploration with knowledge sharing from their mentors and specialized institutions. Team of students will communicate to share ideas and redesign their prototypes as needed. They can control their own ideas and design their own investigations also. Decisions about solutions will be student-generated only. All teams will be involved in productive teamwork.

A lab will be also engaged with guided by institutional support for each MBBK project.The students will be allowed for finding out multiple right answers (divergent thinking) and reframe failure as a necessary part of learning. When designing and testing prototypes, teams may flounder and fail to solve the problem, but that will be okay. They will be expected to learn from what went wrong, and try again. Failure would be considered a positive step on the way to discovering and designing solutions. **Online environment**will offer rich possibilities for creative solutions.

Online MBBK portal for communication, knowledge sharing, supporting, which will be responsible for-

- **Engaged and network community**
- **Accessible learning process with multimedia contents & virtual tours**
- **Education experiences with transdisciplinary approach**
- **Flexible and inclusive learning spaces supported by innovative technologies**
- **Innovative and assessable measures of learning**

How MBBK online portal works



Purpose of the online knowledge portal -

- Develop idea and validation group wise – team wise
- Provide online mentoring accessibility - ATL/technical institution nearby also can assist
- Online support for problems and provide platform to upload their project status at various level
- Continue information sharing through open ended knowledge sharing portal for learning sharing, evaluation and monitoring

Partners for mentoring and design lab support

MBBK would associate with institutions or individual experts those invite, encourage and excited about the innovative best possible solutions can be our partner in this program. The team of these partners will act for facilitatinglearning environment, technology support and the group work dynamics from various stream of knowledge for developing sustainable projects.

There will be free lab space available for individual MBBK project which will supported and guided by various partners as team in collaborative manner. During the MBBK program an Ideas Lab will be engaged with each groups of young kids, a selected group of experts from a diverse range of disciplines and different career levels come together to immerse themselves in an inspiring collaborative thinking process. In this creative environment, the Ideas Lab facilitates the formation of transdisciplinaryproject teams around innovative research concepts. The Ideas Lab aims to enable the selected team performing interdisciplinary innovation that has a strong societal benefit, potentially taking revolutionary approaches to the complex challenges.

The emphasis of these partners are placed on a cross-disciplinary approach to foster new collaborations and bring new thinking to the problem encouraging innovative ways of problem-solving. This innovative method will encourage the co-operative generation of new ideas and will open possibilities for completely new research constellations and boundary- spanning activities.

The associate partners would be as following -

a. **School** – any schools itself with STEM lab, ATL and AIM entity will the key partner for the project development. These partners will provide the core equipment and facilitate free space for MBBK project development**.**
b. **Science, arts and innovation center/institutions**
c. **The Institute for Sustainable Technologies** - National Research Institute, state owned scientific and research institute with experience in international co-operation on scientific, research, development and implementation projects.
d. **Individual facilitators** - identified the competences required, designs the sessions, upload sessions, connect with students' groups, manages and runs the session using a variety of techniques of STEAM.
e. **Institution for mentoring** – mentors and lead institution from various stream will be partner for MBBK innovation projects. The training, capacity building and project development may complete under guidance or cooperation of these partner institutions.
f. **Organizations already running STEAM programs** – there are various organization implementing STEM, ATL and AIM programs in India those who can support for online mentoring, project development and curriculum/UbD(understanding by design for each STEAM project) will be the partner of the MBBK.
g. **Industries and entrepreneur** – any small, micro or macro level industry which work with unique approach to innovative and creative thinking solution for the society which lends itself to a wide variety of applications.

Development Process of a *Main Bhi Banu Kalam*

1. **Identify young innovators**
2. **Orientation and online workshops to understand innovation process and program**
3. **Collaborative team**
4. **Innovation design and support system/mentoring**
5. **Visits to R & D institutions**
6. **Innovative project development process – STEPs**
    a. **Study real world problem**
    b. **Creative ways of developing the new insight**
    c. **Ideation/Design process**
    d. **Prototype development**
    e. **Deployment and implementation**
    f. **Evaluation and assessment**
7. **Project support and future innovations, show casing & participation in events**

Here are the details-

1. **Identify young innovators-**

   The MBBK team will be discussion with the various schools at various level and communicate with school management about everything related to the program. This program willbe being largely about designing creative solutions for real-world problems. When students learn within the context of authentic, problem-based STEAM design, they can more clearly see the genuine impact of their learning also. That kind of authenticity builds engagement, taking students from groans of "When will I ever use this?" to a genuine connection between skills and application.

   There will be a formal introduction given to the students and teachers among the listed schools. Students will have selected on the interest level connecting with creativity, ideation, STEAM applied knowledge and understanding level about surrounding environment. Students can send their recorded video, audio, text, art work about their creative ideas and works to show their out of box thinking. Small test also can be taken about subject knowledge and basic skill check for digital literacy/adaptive learning/physical learning/design thinking/computational thinking etc.

   Target level-

   - Classes 6th to 8th for **Junior** Category
     and Classes 9^{th} to 12^{th} separately for **Senior** Category.
   - Vocational Trainees(ITIs/ School dropouts upto age of 18 years)
   - Classes 3^{rd} to 5^{th} for pre-teen age group kids to prepare them for *Main Bhi Banu Kalam* programme

2. **Orientation and online workshops to understand innovation process and program-**

   First of all, we want students to learn through online orientation program how to develop a critical stance with their work: inquiring, editing, thinking flexibly, and learning from another person's perspective.

   This work shop will enable students from elementary to high school to wonder, design, and invent a real idea/creative solution that solves real problems. Develop problem-solving ability which involves finding answers to questions and solutions for undesired effects.

   Generate more curiosity in children about -

   - Learning about tools and equipment's
   - Develop ability of ideation, design thinking and computational thinking process in the children
   - Introduction to physical computing and building real time projects, make students makers

3. **Collaborative team –**

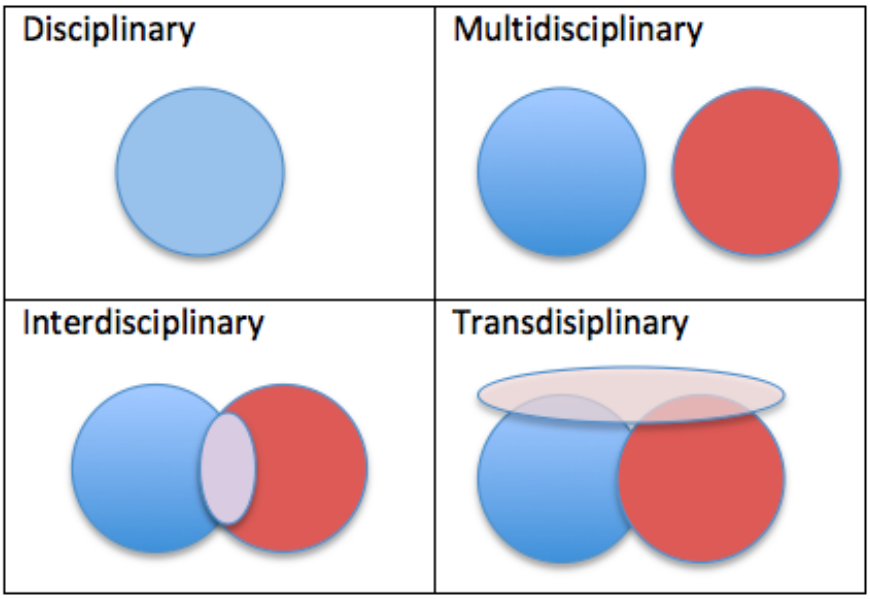
   If we atomize people and separate them and judge them separately, we form a kind of disjunction between them and their natural learning environment. We need to identify these creative kids and then join them as a team those can look at the world around them as a playground for ways in which to make their world better.

   Grouping students on various projects and provide them mentoring supports. Like – energy group, food and agribusiness group, health care group, rural development group, social innovation group, sustainable development group. The group will be supported through subject experts, mentors and specialized institution in a transdisciplinary manner.

   Transdisciplinary collaboration requires that all teachers are involved and collaborate. They must shift away from the comfort zone of working individually by sharing ideas with others for the purpose of integrating learning experiences. This results in building meaningful and enduring understandings for students. Engage leaders'/principal school mentors also with the project development process.

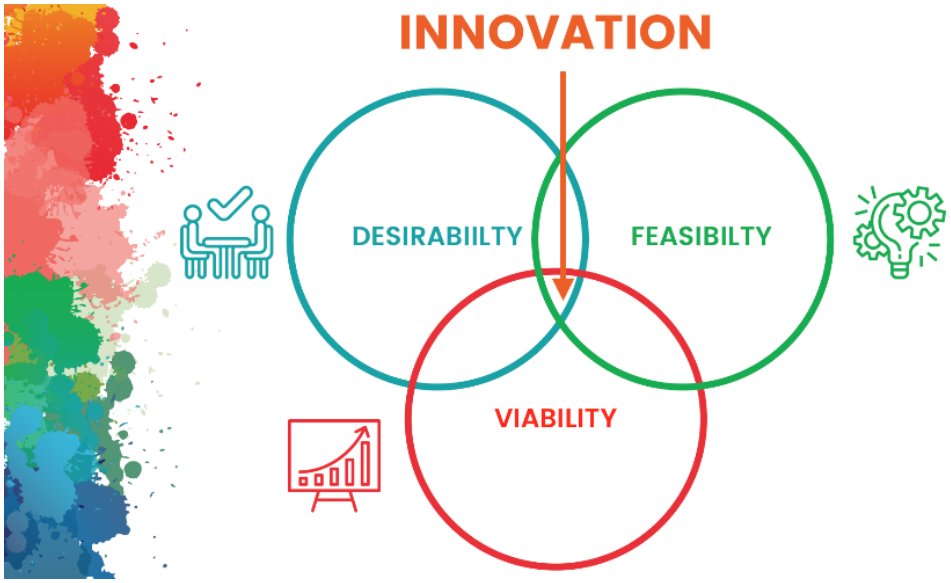
   Collaboration project team

   1. Engaged and network community – kids, teacher, institution, mentors
   2. Accessible learning process for each level through online knowledge portal
   3. Sharing education experiences with transdisciplinary approach
   4. Flexible and inclusive learning spaces supported by innovative technologies



4. Innovation design and support system/mentoring

Scientific knowledge and engineering skills are a primary support for the innovation. Generating new ideas and new approaches are ways of conceptualizing innovation. Innovation results in new knowledge which, in turn, leads to the development of technologically new or improved products and processes for existing one else creative solutions for a problem which have social impact on real sense.



S T E (A) M

These below iterative steps will involve young kids in asking critical questions about the problem, and guide them through creating and testing actual prototypes to solve that problem.

Science: The study of the natural world.

Technology: The definition for technology includes any product made by humans to meet a want or need. (So much for all technology being digital.) A chair is technology; so is a pencil. Any product kids create to solve a problem can be regarded as technology.

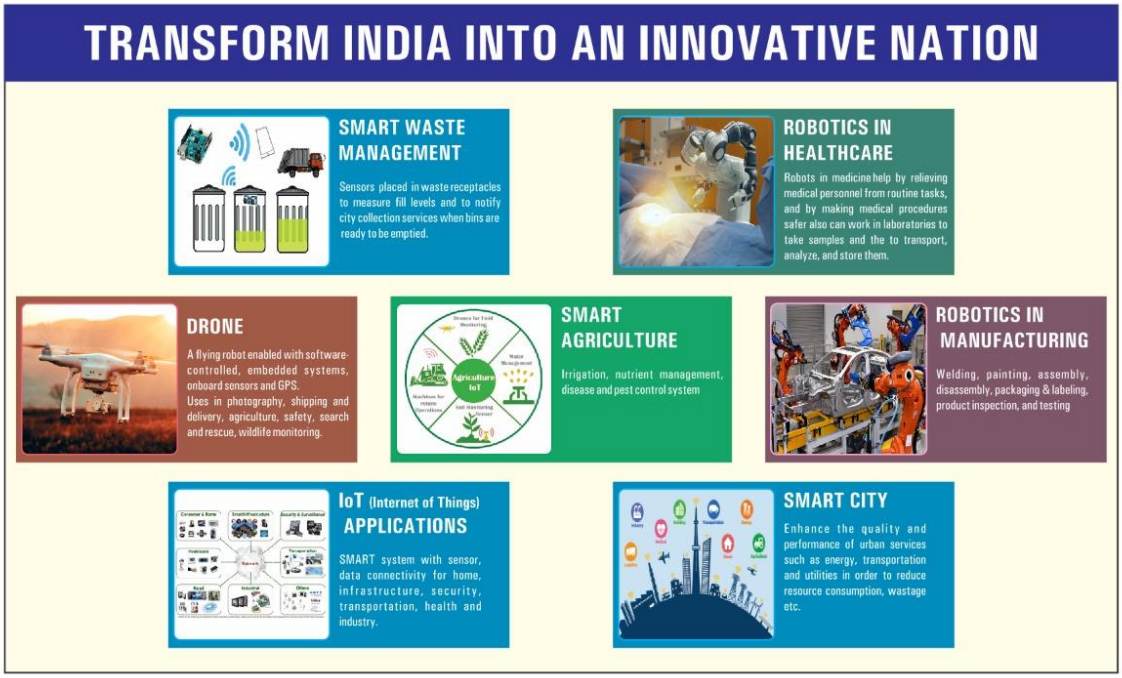
Engineering: The design process kids use to solve problems.

Art – articulated visualization of problem and designing new thought.

Math: reasoning, data analysis, calculation uses for project development process.

Few examples of real world problems-

- ✓ Soil erosion – SMART Agriculture
- ✓ Growing food in arid zone/during the flood – Green engineering
- ✓ Solving the SMART village needs or City deign needs – SMART City/Village
- ✓ Creating clean water – World environment
- ✓ Improving life of disabilities – physical/mental
- ✓ Renewable energy uses – Green engineering
- ✓ Stop Oxidation in vegetable and fruits – SMART Agriculture



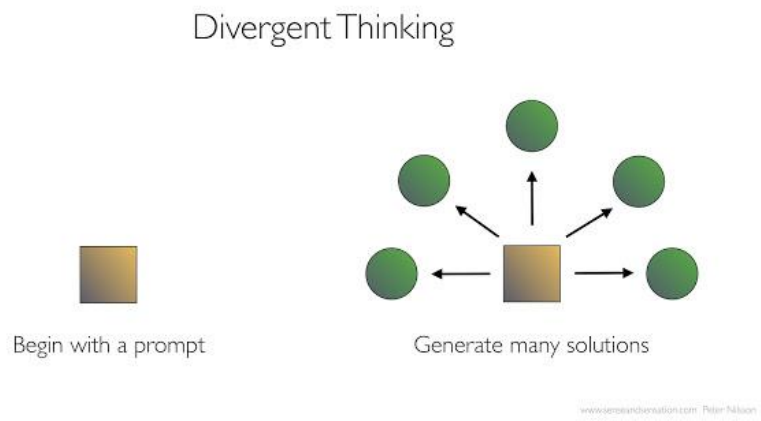
5. **<u>Visits to R & D institutions:</u>** Students will be given opportunity to visit various R & D institutions, industries and knowledge parks so that they can have real world experience

6. **<u>Innovative project development process – STEPs</u>**
   a) **Study real world problem** from surrounding social-economic environment-real-world problems presented through service learning help students to engage in active learning and problem solving, which can develop sustainability knowledge, create newperspectives andprovide them with exposure to authentic techniques in the practice of ST(E)AM.

The study should collect the data of surrounding environment.set of indicators is easy to measure and gives an accurate idea of the work carried out

   b) **Creative ways of developing the new insight**-Allow students to create or capture their creations/ideas and share with others. Supported by the experts and technology lab to use it effectively in a project. Developing deep understanding of challenging project for an array of the students. Find out multiple best solutions in divergent thinking.

Divergent thinking- what is usually referred to thinking outside the box, and is often associated with creativity.



i. Reversing the question/answer paradigm.
ii. Let the music play/develop non-formal/non-judgmental environment.
iii. Inquiry-based feedback- more open-ended and in-depth approach for evaluating students' work.
iv. Encourage play and manage failure.
v. Using art strategies- less concerned about exact interpretation and more open to poetry, metaphor, and dream imagery in general.

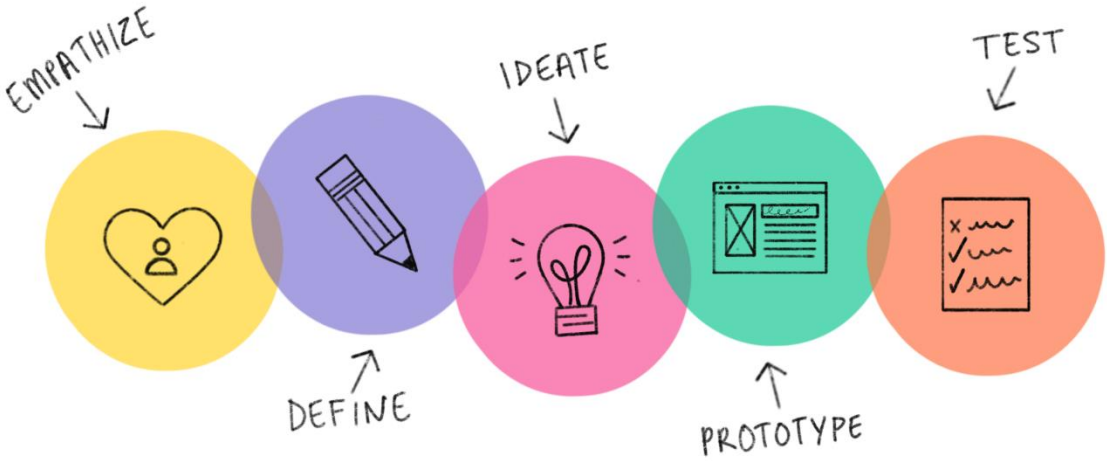
c. **Ideation/Design process-** to create learning opportunities crafted around big ideas and understanding. Then deign can be used as the basis for integrating technology. Technology can become thinking tool and student can learn to use the technology to solve problems, organize, analyze and present information.How students can create ideas? got a challenge you need to be solved? having difficulty coming up with new ideas to solve it? Applying design thinking and ideation principles in a group think? the answer can take one of these forms:

- The student already has a great idea of their own
- The teacher gives the student a great idea
- The student explores STEAM to come up with their own idea.

Design thinking is a way of creatively solving challenges using materials in a set timeframe. Importantly, there are three steps involved

1. Identifying; what the actual problem is that you're trying to solve?
2. Ideation; coming up a large array of ideas that could solve the problem
3. Iteration; prototyping and testing multiple ideas, getting ever closer to the solution

Example- The students have put in a garden as part of a unit on food sustainability and eco-friendly gardening. Despite their best efforts, the students find that a particular plant bed consistently produces poor quality vegetables with one of the fruit trees dying quickly no matter how much water or fertiliser is applied. The students think that the cause might be soil itself and so begin to remove the soil, however on doing so, they find that water begins seeping up out of the ground as soon as they remove the topsoil. The teacher speaks with the grounds assistant who finds that the actual cause is a broken pipe that runs underneath the fruit trees. Once the pipe is fixed, the students change the depth of the garden beds and plant vegetables with shallow roots.



d. Porotype development-

Prototypes are routinely used as part of the product design process to give designers the ability to explore design alternatives, test theories and confirm performance prior to starting production of a new product. Almost every STEAM discipline uses prototypes in some ways.

A prototype is a working model of a product that is used for testing before it is manufactured. Prototypes help designers learn about the manufacturing process of a product, how people will use the product, and how the product could fail or break. A prototype is not the same thing as a model. A model is used to demonstrate or explain how a product will look or function. A prototype is used to test different working aspects of a product before the design is finalized.

Example - a team of STEAM designing a new cell phone might produce several cardboard and paper models to illustrate how the final product would look and feel. They may survey the general public to gain feedback about how the cell phone could look. The team might build a sturdier plastic prototype to test how

easily the cell phone could break when dropped. If the prototype does not meet the team's design requirements, then they may complete an "iteration." Iteration is when students try again and re-design, re-build and re-test. Students often iterate many times before determining the final solution to a problem. Once a successful prototype has been developed, the STEAM team can use it as a mock-up for full-scale manufacturing.

e. Implementing and deploying innovation project-

As many STEM education projects rely on short-term funding periods, achieving sustainability can be a challenging aim for project coordinators. Sustainability of a STEM education project can be described as the project's ability to maintain all-Continuation of activities, sustaining impact, community engagement and collaboration, leadership, planning and evaluation.

STEAM project needs to finds successful operational model, STEM education projects tends to rely on networks of support in order to achieve their aims. Networks may involve other projects or organizations with similar or balancing aims, teacher, parent or researcher communities, teacher organizations, non-governmental organizations or private associations. **Vigyan Bharati** will also join for industrial and institutional ties up of each successful model project of MBBK

f. Evaluation and tracking development process – each project will be track online through open ended development modules and each stage needs to be clear with in the time frame given. The evaluation design integrated a mixed-methods approach into an objective-based evaluation, yielding quantitative and qualitative data that will serve both formative and summative purposes.

To assess the effectiveness of the projects in achieving its goals, all students and teachers participated in content-specific pre- and post-tests related to the materials and activities they will be presenting with project deployment.

Assessment of each *Main Bhi Banu Kalam* project- assess students work during the implementation of the project in critical, creative way of student project work –

- Feedback about learning
- Process identification in various stages of project development
- Innovation assessments

Assessment variable (what will assess) of each team and individuals about their projects will be-

i. Explain phenomenon
ii. Interpret
iii. Apply
iv. Demonstrate understating

v. Demonstrate empathy
vi. Seek knowledge how he/she grow self with the project
vii. Case study and complete story of project

Collaboration project community will work with each project following objectives -

i. Formative assessment
ii. Noticing development process
iii. Motivation support wherever require
iv. Notice where they are struggling

The participants would also be evaluated at school, district, division, state and national level.

7. Project support & future innovations

Promoting - providing national level platform to the young innovators. Promoting and providing national level platform to the best innovations those will be supported by the **Vigyan Bharati** on various level of institution and industry both. These ***Main Bhi Banu Kalams*** will be identified, promoted and supported by VIBHA for following level–

- **Creating sustainable solutions for social causes**
- **Rewarding innovative thinking through industry and institutions**
- **Explore new technology support for new development**
- **Sourcing incubation programs and creating potential startup with help of various institution**
- **Individual students will be also promoted and endorsed for higher level education through institutional partners of the program. Scholarships, preference entries may also be provided to these future Kalams based on their skill and work.**
- **Opportunities will be made available students to showcase projects in national/international level programmes like IISF**
- **Data of *Main Bhi Banu Kalam* Programme may be made available to Government for strategic planning**

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