DEVELOPMENT OF STEAM PARK AND WEATHER STATION

PAC 23.24

2022-23

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Title: Development of STEAM Park and Weather Station

Introduction: STEAM stands for Science, Technology, Engineering, Arts and Mathematics and STEAM pedagogy encompasses various activities which involve the integration of STEAM in the classroom. As we move from STEM to STEAM, the integration of arts in STEM has been done to improve student learning, creativity and competencies. STEM was coined by the NSF (National STEAM Foundation) in the USA two decades ago and since then STEM has gained much popularity and has proved to be an effective pedagogy in enhancing student learning and achievement To improve and inculcate the 21st Century skills among the learners, arts was added to STEM and this gave birth to STEAM. Hence STEAM education promises to inculcate among the learners problem solving through innovation, creativity, critical thinking, communication, collaboration and competencies required in the real world. As National Education Policy 2020 "no hard separations between arts and STEAMs, between curricular and extra-curricular activities, between vocational and academic streams, etc. in order to eliminate harmful hierarchies among, and silos between different areas of learning"

STEAM Park will help to build child's natural curiosity and desire to create, explore, and investigate the world of early STEAM, science, technology, engineering, art, and maths (STEAM) through creative play. It will provide a natural and free environment for students to learn and familiarize with different scientific concepts. It will also provide innovative ways to communicate STEAM, learning to enthuse, entertain, initiate, excite and to know about the developments of STEAM and technology. The park will also attempt to enhance public understanding of STEAM and spread scientific literacy. It will also fulfil the need of Demonstration Multipurpose School in the RIE campus and societal needs.

Specific Objectives:

- To create STEAM learning environments to enable students for establishing connections on integration between science, technology, engineering, arts and mathematics.
- To provide atmosphere in the form of access points like working models, visual arts, charts, activities, puzzles etc. to engage students in the process of inquiry, dialogue, and critical thinking in the lines of STEAM.
- To provide facilities for hands on experience to children, teachers and teacher educators through learning by doing.
- To inculcate scientific temper and spirit of inquiry among the students.
- To build linkage between STEAM and society and promote citizen science.

Work progress in the current year

Procurement of soil and Development of the Medicinal garden –

The existing medicinal garden was further developed with addition of many new medicinal plants.

Beautification of the STEAM Park.

Around 50 pots were purchased for planting seasonal and other plants. Pots have placed in different parts of the science park. For beautification and easy approach to the Science Park area, second phase work of paver pathways was done. Below are shown the images of the work done.

S.N	Name	Botanical name	family
1	नागदोन	*Euphorbia tithymaloides*	Euphorbiaceae
2	अजवाइनपत्ता (□□□□□□)	*Plectranthus amboinicus*	Lamiaceae
3	अग्निमन्था	*Premna integrifolia*	Verbenaceae
4	भारंगी	*Clerodendrum indicum*	Verbenaceae
5	रात रानी	*Cestrum nocturnum*	Solanaceae
6	हथकंध(गजकर्णी)	*Leea macrophylia*	Vitaceae
7	उलटकंबल	*Abroma augustum*	Sterculiaceae
8	दमबेल	*Tylophora indica*	Asclepiadaceae
9	वनभटा	*Solanum indicum*	Solanaceae
10	गुड़मार	*Gymnema sylvestre*	Asclepiadaceae
11	मालकाँगनी	*Celastrus paniculatus*	Celastraceae
12	अश्वगंधा	*Withania somnifera*	Solanaceae
13	निर्गुन्डी	*Vitex nigundo*	Verbenaceae
14	पुनरनवा	*Boerhavia diffusa*	Nyctaginaceae
15	सर्पगंधा	*Rauwolfia serpentina*	Apocynaceae
16	बाकूची	*Psoralea corylifolia*	Papilionaceae
17	बहेडा	*Terminalia bellirica*	Combretaceae
18	बच	*Acorus calamus*	Araceae
19	शिवनाक	*Oroxylum indicum*	Bignoniaceae
20	गुल्बकवली	*Hedychium coronarium*	Zingiberaceae
21	सौफ़तुलसी		
22	खस(vetiver)	*Vetiver zizanioides*	Poaceae
23	वनतुलसी	*Ocimum gratissimum*	Lamiaceae
24	भीमवासीArtimicia	*Artemisia vulgaris*	Asteraceae
25	Stevia	*Stevia rebaudiana*	Asteraceae
26	कलाधतूरा		
27	अंजीर	*Ficus carica*	Moraceae
28	सरफोक(Sarphonk)	*Tephrosia purpurea*	Fabaceae
29	भृंगराज	*Eclipta prostrata*	Asteraceae
30	मकोई	*Solanum nigrum*	Solanaceae
31	केवड़ा		
32	मोगरा	*Jasminum sambac*	Oleaceae
33	गूगलComiphora)	*Commiphora wightii*	Burseraceae
34	अतिबाला(Abutilon)	*Abutilon indicum*	Malvaceae

35	जलजामूनीcoculus	*Cocculus hirsutus*	Menispermaceae
36	श्यामा तुलसी		
37	मारू तुलसी		
38	राम तुलसी		
39	चित्रक	*Plumbago zeylanica*	Plumbaginaceae
40	सतावर	*Asparagus racemosus*	Asparagaceae
41	पीपली	*Piper longum*	Piperaceae
42	□□□□□□□	*Hedychium spicatum*	Zingiberaceae
43	अमलतास	*Cassia fistula*	Caesalpiniaceae
44	□□□□□□	*Jatropha curcas*	Euphorbiaceae
45	निशोद	*Operculina terpethum*	Convolvulaceae
46	अपराजिता	*Clitoria tematea*	Fabaceae
47	अपामार्ग	*Achyranthes aspera*	Amaranthaceae
48	अकाव	*Calotropis gigantea*	Asclepiadaceae
49	□□□□□□□	*Barleria prioniti*	Acanthaceae
50	वैजन्ती		
51	भुई आंवला	*Phyllanthus niruri*	Phyllanthaceae
52	वन □□□□□	*Ocimum gratissimum*	Lamiaceae
54	□□□□□□□□	*Kaempferia galanga*	Zingiberaceae
56	नागरमोथा	*Cyperus rotundus*	Cyperacea
57	गुंजा	*Abrus prectorius*	Fabaceae
58	अर्जुन	*Terminalia arjuna*	Combretaceae
59	मंडूक परनि	*Centella asiatica*	Apiaceae
60	मरोड़ फली	*Helicteres isora*	Sterculiaceae
61	अकरकरा	*Spilanthes acmela*	Asteraceae
62	गिलोय	*Tinospora cordifolia*	Menispermaceae
List of Medicinal Plants in the Science Park Area			

List of exhibits in the STEAM Park Area

1. Geodesic Dome
2. Lissajous Figures
3. Vortex
4. Lissajous Figures
5. Friction and Speed
6. Crystal Structure
7. Musical Tubes
8. Bird in a Cage
9. Gyroscope
10. Magical Pendulum
11. Plancks Law
12. Swinging Pendula
13. Whispering Dishes
14. Pulley reduces effort
15. Rolling Disc
16. Hole in the palm
17. Win the race
18. Double ended cone
19. Cycloid Path
20. World Time
21. Centrifugal force
22. DNA model
23. Action and Reaction
24. Magical Tap
25. Perception of Depth
26. Set of Levers
27. Inclined Planes

28. **Archimedian Screw**
29. **Lift Yourself**
30. **Mathematical Scale/Abacus/ Hanoi Tower**
31. **Circular Disk**
32. **World of Numbers**
33. **Cartesian Plane**
34. **Circular Geo Board**
35. **Geo Board**
36. **Catenary**
37. **Full Protector**
38. **Euclidian Space R^3**
39. **Blast Furnace Model**
40. **Floating Table**
41. **Echo Tube**
42. **Projectile**
43. **Sympathetic Swing**
44. **Brachistochrone curve**
45. **Wave Formation**

Workshop for the development of STEAM Park from November 1-10, 2022

Workshop for the development of STEAM Park was held in the month of November 1-10, 2022. Five ITI experts from Alirajpur and other resource persons participated in the workshop.

Inauguration of the workshop

Inauguration of the workshop

ITI Experts making different models

Several models were built and installed during the workshop. The models are as follows:-

1. Gravity Tower
2. Resonance Strips
3. QR Code model
4. Vortex
5. Pyramid
6. Pythagoras Theorem
7. Periscope

Periscope model installed in STEAM Park

360º Rotatable Periscope

Generally a periscope (or sea telescope) is a viewer of distant object that does not have direct access from ground. Mostly it is an essential component of submersible ships.

Periscope model installed in STEAM Park

Resonance Strips in the making

Several Models being constructed by ITI Experts

Interaction with the resource persons

Discussion on Gravity Tower

Gravity Tower model working is tested

Acc to
Pythagoras Theorem
$H^2 = B^2 + P^2$
$H^2 = 4^2 + 3^2$
$H^2 = 16 + 9$
$H^2 = 25$
$H = \sqrt{25} = 5$ Unit

Length of stair

Gravity Tower- It is structure made of iron angles/pipes such that each joint would allow movement in at least one direction. By plumb line you can easily identify the vertical plane passing through its center of gravity. Now hang a plumb line at the center of gravity found earlier. Move structure and note down observations.

Making of the Pyramid model

QR code model is being constructed

Resonance strip model is being constructed

Periscope model is being constructed

Acc to
Pythagoras Theorem

$H^2 = B^2 + P^2$

$H^2 = 4^2 + 3^2$

$H^2 = 16 + 9$

$H^2 = 25$

$H = \sqrt{25} = 5$ Unit

Finding Length of stair

Pythagoras Theorem – Using Pythagoras Theorem length of stair can be calculated. However it is required that size and length of each box/stair is same.

In vortex model – In this model the rotating fluid subjected to centrifugal force creating funnel shaped formation like tornado. A suitable modification was done to this model. Instead of water the tube has been filled with oil. As water evaporated so we have filled the tube with oil.

Resonance Strips model

Strips of different lengths are attached to the base so that one strip of a given length is moved the energy is transferred to the other strip at a distance but of the same length. This phenomenon can very well be explained by the principle of resonance. This model consists of seven metal strips fixed on a wooden block. Out of these, there are three pairs of strips of different lengths and colours and a single metal strip. This model demonstrates the relationship between length, frequency and resonance.

Previous Year Development

First Phase workshop for the development of STEAM Park from October 6-20, 2021

The first phase workshop for the development of STEAM Park was held in the month of October from 6 to 20, 2020. Seven ITI experts from Alirajpur participated in the workshop.

Inauguration of the workshop

Several models were built and repaired in this workshop as given below:-

Periodic Table

The periodic table is a tabular display of the chemical elements, organized on the basis of their atomic numbers, electron configurations, and chemical properties. Elements are presented in increasing atomic number.
A team of children can play quiz over this table by locating elements, identifying their symbol and their atomic number along with their crystalline structure.

Pi Gate

Archimedes experiment to calculate pi

Tessaract (4D cube)

A tesseract is the four-dimensional analogue of the cube; the tesseract is to the cube as the cube is to the square. Just as the surface of the cube consists of six square faces, the hypersurface of the tesseract consists of eight cubical cells. The tesseract is one of the six convex regular 4-polytopes. A tesseract, also known as a hypercube, is a four-dimensional cube, or, alternately, it is the extension of the idea of a square to a four-dimensional space in the same way that a cube is the extension of the idea of a square to a three-dimensional space.

Second Phase workshop for the development of STEAM Park from March 3-12, 2022

Inauguration of the workshop

The secomd phase workshop for the development of Science Park was held in the month of March from3 to 12, 2022.Five ITI experts from Alirajpur science park, painting artists and others participated in the workshop. Several models were built and repaired in this workshop as given below:-

Infinity Well
Tug of War
Maxwell's Disc
Gramaphone
Angular Momentum

Angular Momentum

Concentration of mass of rotating axis increases angular velocity and angular momentum is explained through this single seat merry go round.

Infinity Well
https://www.youtube.com/watch?v=6PTnRBo9q00

An infinity well works on the principle that when two plane mirrors are placed in front of each other an infinite number of images are produced thus creating an illusion. The deep infinity effect is created through the light source. When the light is turned on, it bounces between the reflective surface of the two mirrors, but on the two-way mirror side, some of the light passes through. When the light escapes, it gets fainter inside, which also fades the infinity effect.

In other words, the reflections seem to be receding into the distance. This is because the light actually is traversing the distance it appears to be traveling. Each additional reflection adds length to the path the light must travel before exiting the mirror.

Set of gears

Machines of all kinds are essentially an assembly of several moving parts. Motion of one part is often transmitted to another part which sets it into motion. This is what makes machines highly useful and efficient. In this exhibit you can see the different mechanisms that transfer rotation. Observe the effect of direction and speed of rotation that you impart on one rotating mechanism on the other.

Transmission of motion often involves the usage of the gears to provide speed and torque conversions from a rotating source to another device. These gears are usually seen in bicycles, motor vehicles, machines etc.

Gears have teeth that mesh up with another toothed part to transmit torque. A Gear train has at least two gears. One that is attached to the rotating source is the drive gear called input gear or pinion and the other is driven gear or simply a gear. The mechanical advantage of the gear train is the ratio of the number of teeth in the output gear to the number of teeth in the input gear. If the output gear has more teeth than the input gear , the gear train amplifies the input torque. And, if the output gear has fewer teeth than the input gear, then the gear train reduces the input torque. There are various types of gears. Spur gears are the simplest types of Gears where the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts

Different types of gears are shown in this exhibit.

Tug of War

This is a fun model in which two teams pull at opposite ends of a rope until one drags the other over a central line. The two teams pull on opposite ends of a rope, with the goal being to bring the rope a certain distance in one direction against the force of the opposing team's pull. Several principles of physics like Newton's first and second law of motion can be easily explained through this model.

Beautification of the Musical Tubes experiment

Beautification of the Sun Dial Experiment

Best out of Waste (Gramophone Model)

Beautification of Floating Table
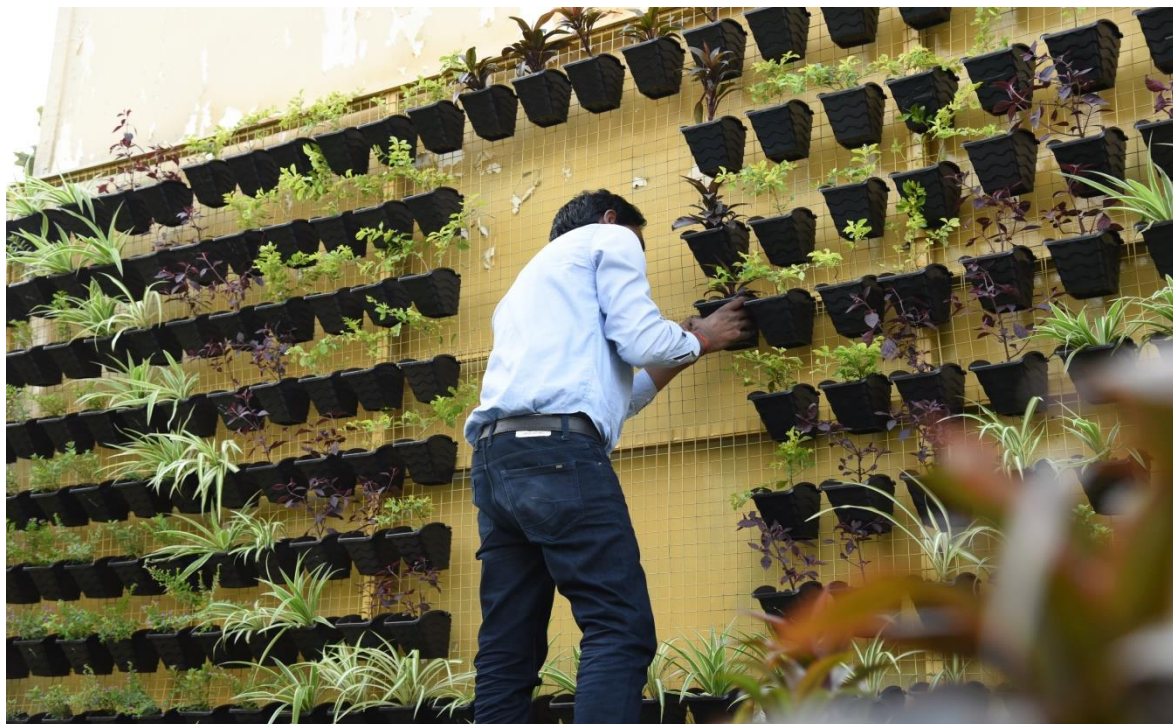
Beautification of Magical Tap

Testing the various exhibits

Second Phase workshop for the development of STEAM Park

Fixing of the vertical garden

ITI Experts making various models

Other exhibits in the science park (Already installed in the previous year)

1. Mathematical Scale/Abacus/ Hanoi Tower/

A number line is a pictorial representation of numbers on a straight line. It's a reference for comparing and ordering numbers. It can be used to represent any real number that includes all integers (…-3, -2, -1, 0, 1, 2, 3,…), fractions (1/4, 1/2, 3/4…) etc.

An instrument for performing calculations by sliding counters along rods or in grooves. A slab that forms the uppermost member or division of the capital of a column

Tower of Hanoi is a mathematical puzzle where we have three rods and n disks. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

1.   Only one disk can be moved at a time.
2.   Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.
3.   No disk may be placed on top of a smaller disk.

3. Circles

4. Circular Disk

Try to find relation and properties among various parts of the circle as radius, diameter, chord, angle subtended at circumference, center etc.

5. World of Numbers

Rotate the wheels to get a valid mathematical expression by using various mathematical operations as addition, subtraction, division, multiplication, decimal, less or greater than, equals to, etc. given on the wheel.

6 .Cartesian Plane

A Cartesian plane is defined by two perpendicular number lines: the x-axis, which is horizontal, and the y-axis, which is vertical. Using these axes, we can describe any point in the plane using an ordered pair of numbers. The Cartesian plane extends infinitely in all directions.

7. Circular Geo Board

Circular Geoboard has some equally spaced peg arranged on multiple different circumferences of a circle and one peg at the center. It is used to draw the various geometrical shapes and to explore the circle related theorems with the help of stretchable bands.

8. Geo Board
A geoboard is a mathematical manipulative used to explore basic concepts in plane geometry such as perimeter, area and the characteristics of triangles and other polygons. It consists of a physical board with a certain number of nails half driven in, around which are wrapped geo bands that are made of stretchable bands.

7. Catenary

A catenary is the curve that an idealized hanging chain or cable assumes under its own weight when supported only at its ends. The catenary curve has a U-like shape, superficially similar in appearance to a parabolic arch, but it is not a parabola.

8. Full Protector

It is a semi-circular disc used to draw and measure angles. It is graduated from 0 to 360 degrees and can be directly used to measure any angle within its range. It has two sets of markings, 0 to 360 degrees either clock wise or anti clock wise.

9. Euclidian Space R³

In geometry, a two- or three-dimensional space in which the axioms and postulates of Euclidean geometry apply; also, a space in any finite number of dimensions, in which points are designated by coordinates (one for each dimension) and the distance between two points is given by a distance formula.

10. Blast Furnace Model

A blast furnace is a type of metallurgical furnace used for smelting to produce industrial metals, generally pig iron, but also others such as lead or copper. Blast refers to the combustion air being "forced" or supplied above atmospheric pressure.

In a blast furnace, fuel (coke), ores, and flux (limestone) are continuously supplied through the top of the furnace, while a hot blast of air (sometimes with oxygen enrichment) is blown into the lower section of the furnace through a series of pipes called tuyeres, so that the chemical reactions take place throughout the furnace as the material falls downward. The end products are usually molten metal and slag phases tapped from the bottom, and waste gases (flue gas) exiting from the top of the furnace. The downward flow of the ore along with the flux in contact with an

upflow of hot, carbon monoxide-rich combustion gases is a countercurrent exchange and chemical reaction process

Blast Furnace

Iron ore coke and lime stone

Hot waste gases

Hot waste gases

400°C

Steel lined with heat-resistant bricks

Hot air blast
Tap hole for Iron

1800°C

MOLTEN SLAG

MOLTEN IRON

Hot air blast
Tap hole for slag

11. Floating Table

Floating tables give an illusion effect. It seems like how table can stand on chains instead of solid legs. There is nothing magical about it, its plain physics.

This table is made on the principle of TENSEGRITY which is a design principle that applies when a discontinuous set of compression elements is opposed and balanced by an internal prestress that stabilizes the entire structure. This was a term coined by Buckminister Fuller an iconoclastic architect, engineer and poet to describe his vision of a new kind of architecture one that looked like it was built by nature instead by humans.

12. Echo Tube

Position your ear at the open end of the pipe and clap your hand. Echo of the clap caused by the reflection of sound at the far end of the pipe can be distinctly heard. Our brain can distinguish sounds that impinge on the ear at least 0.2 seconds apart. In our exhibit, sound takes about 0.4 seconds to make a to-and-fro trip. Therefore, the echo or the reflected sound, is heard clearly.

The tube here is thirty metre long. It is placed at a certain height from the ground. One end of the tube has been covered with the same material as that of the tube where as the other end is open.

Clap or say "ha" near the open end. The sound that you hear back is a series of claps or "ha"s one quickly following the other. But if you observe carefully, all of them are not of the same pitch (frequency). You would first hear a high frequency followed by the low frequencies.

When we clap or say 'ha' we are producing a sound wave. The sound waves travel in air at a speed of ~340 m/s. When any wave encounters a change in the propagating medium, it undergoes reflection, refraction and transmission. Likewise, the sound waves produced near one end of the tube also get reflected from the walls of the tube and the closed end along with being refracted and transmitted. These reflected waves travel back to the open end and reach our ears.

If the time difference between the first sound and the next sound is more than 0.1 second, then our brain perceives them as two different sounds which is called an echo. If the time difference is less than 0.1 second, then the first sound would still be in our memory when the second sound strikes our mind. Then the brain perceives it as a prolonged sound. This is reverberation.

If we want to hear an echo, the time difference between the sounds should be more than 0.1 second. If sound travels ~340 metre in 1 second, it can travel 34 metre in 0.1 second. Therefore, if the length of the pipe is more than 17 metre the sound wave would take more than 0.1 second to reach back to the open end. Thus, the required time difference for the echo to be heard can be achieved. But, the echo heard is a series of sounds of decreasing frequencies. The reason is, the clap or the 'ha' sound we make, is actually a mixture of different frequencies. A high frequency wave will have a short wave length and does not encounter many reflections from the side walls of the pipe. So, it gets reflected from the closed end and reaches back the open end faster than the other low frequencies. Therefore, the frequencies get separated in the echo. One can listen to the transmitted sound near the closed end of the tube.

13. Projectile

Place a ball within the funnel provided at the top and drop it with the help of the ladder provided The ball strikes the metal plate fixed at the bottom and bounces. Note down the distance of the first leap of the ball bounced from the metal base provided and the angle of the metal plate's position with the help of the protractor. Now change the angle of the metal plate and again release the ball from top. Note down the distance of first leap of the ball. Continue the same procedure for many angle positions till you reach maximum distance and note down corresponding angle of the plate. We can find that only at 45° of the plate, the ball covers maximum distance at the first leap. As per the law of projectile a thrown object can obtain a maximum distance only when it is thrown initially at an angle of 45°. This phenomenon is used in canyons and rifles to achieve maximum distance.

14. Sympathetic Swing

Two persons should sit in the two swings. First person should oscillate while second should be at rest and while swinging the legs of both the persons should be on the foot rest provided. The energy of the first swing is transferred to the second swing and it starts moving and the first swing now comes to rest. The two swings are acting like two simple pendulums and energy transfer takes place because of the resonance between the swings. This energy transfer may lead to perpetual motion but the energy loss due to friction does not permit this.

15. Brachistochrone curve

In physics and mathematics, a brachistochrone or curve of fastest descent, is the one lying on the plane between a point A and a lower point B, where B is not directly below A, on which a bead slides frictionlessly under the influence of a uniform gravitational field to a given end point in the shortest time. The problem was posed by Johann Bernoulli in 1696.
The curve of fastest descent is not a straight (yellow) or polygonal line (green) but a cycloid (red).

16.. Wave Formation

A beautiful model which shows the wave formation and its characteristics. A handle is provided to rotate the disc which in turn causes rotation of the rods attached. The balls engraved on the rods also begin to rotate creating a wave.

Inauguration of Science Park

The Science Park was inaugurated by Korean Ambassador his Excellency Mr. Bong Kil Shin on December 17, 2020 during his visit to RIE Bhopal. It was also proposed to change the name of SCIENCE park to STEAM PARK.

17. Whispering Dishes

The Whisper Dishes are parabolic dishes, meaning they are curved in the shape of a parabola. Parabola-shaped dishes collect, focus and amplify wave signals, including light waves, radio waves and sound waves. The circle at the center of the dish is the focal point. Make a feeble sound such as shaking a bunch of keys or coins in front of the ring, the focus of the Dish. The listener, standing in front of the focus of the other dish hears the sound very clearly.

The effect is due to the parabolic shape of the dishes and the positions of the speaker and the listener. They have to be stationed at the foci of the parabolic dishes. The waves reflected by the speaker's dish are brought to a focus by the other dish.

Whisper a message standing at a particular position in front of one of the discs. The listener, standing in front of the other disc very clearly hears the whisper while no one standing in the path of the two discs can hear the sound.

Whispering dish model installed in the science park

18. Lissajous figures

Sand pours through a swinging bucket to form a lissajous figure. Lissajous figure, also called BOWDITCH CURVE, pattern produced by the intersection of two sinusoidal curves the axes of which are at right angles to each other. First studied by the American mathematician Nathaniel Bowditch in 1815, the curves were investigated independently by the French mathematician

Jules-Antoine Lissajous in 1857–58. Lissajous used a narrow stream of sand pouring from the base of a compound pendulum to produce the curves. The resultant of two simple harmonic motions is explained here with the uniform patterns arrived.

Lissajous figure model installed in the science park

19. Magical pendulum

A mesmerizing pendulum wave demonstration with 13 bowling balls. 13 pendulums each with a unique length. Oscillations of different pendulum is different. All 13 balls on this pendulum have different thread lengths, which results in every single ball having its own periodic time. This

way, they create the optic illusion of a wave. Push all the balls at the same time. That's easy with the included pushing bar and see the magic.

Magical pendulum model installed in the science park

20. Rolling discs

Three discs of equal mass but with different distribution of mass are present. One of the disc has most mass distributed towards its circumference (wheel A). The other one has most mass distributed between the center and the circumference (wheel B). And the last one has more mass near the center (wheel C). Start rotating the discs simultaneously and observe that wheel A will

be keep on rotating for the longest time as compared to wheel B and wheel C. This in agreement with the principle of conservation of angular momentum.

Rolling disc model installed in the science park

21. Newtons Disc

Newton's disc is a disc with segments painted in rainbow colours ie. violet, indigo, blue, green, yellow, orange and red. When the disc is rotated at sufficient speed all colours disappear by merging into a single white colour.

Newtons disc installed in the science park

22. Gyroscope – A device consisting of a wheel or disc mounted so that it can spin rapidly about an axis which is itself free to alter in direction. The orientation of the axis is not affected by tilting of the mounting, so gyroscopes can be used to provide stability or maintain a reference direction in navigation systems, automatic pilots and stabilizers.

Gyroscope model installed in the science park

23. Hyperboloid of one Sheet

In this model, the rod which is depicting a "Straight Line" when revolves around its transverse axis forms a surface called "hyperboloid of one sheet". A hyperboloid of one sheet is a "Ruled Surface" that for each point on the surface, there's a line on the surface passing through it. It can be seen that the plane section along the axis is a hyperbola.

24. Proof without Words

In mathematics, a proof without words is a proof of an identity or mathematical statement which can be demonstrated as self-evident by a diagram without any accompanying explanatory text. By using this model try to show,

$$1 + 2 + 3 + 4 .... + n = \frac{n(n+1)}{2}; n \in N.$$

25. Three dimensional crystal structure: -

A three dimensional crystal structure of NaCl was built. A crystal structure is composed of a pattern, a set of atoms arranged in a particular way, and a lattice exhibiting long-range order and symmetry. NaCl has a cubic unit cell. It is best thought of as a face-centered cubic array of anions with an interpenetrating fcc cation lattice (or vice-versa). The cell looks the same whether you start with anions or cations on the corners. Each ion is 6-coordinate and has a local octahedral geometry.

ITI Experts building various science models

CLAY ARTIST MAKING THE SCULPTURE OF KALPANA CHAWLA

SCULPTURES OF FAMOUS INDIAN SCIENTIST

1. KALPANA CHAWLA
(1961-2003)
First Indian Born woman astronaut

2. Dr. A.P.J ABDUL KALAM
1931-2015
MISSILE MAN AND BHARAT RATNA

3. C.V RAMAN
1888-1970
NOBEL LAUREATE-1930
(for RAMAN EFFECT)

4. S. RAMANUJAN
(1887-1920)
Indian mathematician, he was elected a Fellow of the Royal Society in 1918. Also known as GENIUS OF MATHEMATICS

5. J.C. BOSE
(1858-1937)
Indian scientist Professor who played an important role in the invention of radio and microwave optics

FIXING VARIOUS SCULPTURES OF INDIAN SCIENTISTS

SCULPTURES OF INDIAN SCIENTISTS IN THE SCIENCE PARK

26. Lift yourself Up

An enjoyable interactive play model explains the mechanical advantage gained through pulley system. We can possibly lift objects weighing more than ourselves. We cannot, however, normally, lift ourselves up. But, the arrangement here allows us to do just that. Sit on the chair provided with the system. Pull the free end of the rope downwards. The chair, along with you, moves up! The situation is similar to drawing water from a well. It is a lot easier to lift the weight when the rope runs over a pulley than when it is directly pulled up. A pulley is a simple machine that allows us to change the direction of application of force thereby reducing our efforts. It becomes increasingly easier to lift as we increase the number of pulleys.

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Lift yourself model installed in science park

27. Sun Dial

An ancient day model that is deviced for noting down local time of any place through sun's position. The sundial is one of the oldest and simplest time reckoning devices. It is based on the fact that shadow of an object changes with the position of the sun and hence time. Here we have a plate with a slit in it. The slit is aligned exactly in the geographic north – south direction and inclined at an angle equal to that of the latitude of the place. One can read the local time by the position of sunlight on the dial. In order to obtain the Indian Standard Time (IST), we have to add 19 minutes and 36 seconds to the local time. Another correction from the graph known as 'Equation of Time' has to be applied to arrive at the precise time.
In any sundial, there will be basically two parts :
- **Gnomon**
- **Dial**

Gnomon is generally a rod or a triangular wall pointing north pole of Earth's rotation axis. Depending on whether the dial is in the plane of the equator or on the horizontal plane of the Earth, they are named equatorial dial ant the horizontal dial respectively. In both the types of sundials, the shift in the shadow position is a measure of Sun's apparent motion and in turn is an indication of time.

Sun Dial installed at science park

28. Action and Reaction (Newtons third law)

Wonderful play model for explaining that for every action there is an equal and opposite reaction.

Action and reaction model installed in the science park

29. Geodesic Dome

A geodesic dome is a hemispherical thin-shell structure (lattice-shell) based on a geodesic polyhedron. The triangular elements of the dome are structurally rigid and distribute the structural stress throughout the structure, making geodesic domes able to withstand very heavy loads for their size. Domes can also be constructed with a lightweight aluminum framework which can either be bolted or welded together or can be connected with a more flexible nodel

point/hub connection. These domes are usually clad with glass which is held in place with a PVC coping. The coping can be sealed with silicone to make it water tight. Some designs also allow for double glazing or insulated panels to be fixed in the framework. This allows a fully habitable building to be formed.

Geodesic Dome alongwith the nakshatra garden

30. Animal Structures

Making of various animal structures

Giraffe exhibit in the science park

31. Magical Tap

The floating tap fountain is a clever illusion. It consist of a faucet mysteriously hovering above a pool or basin with an endless supply of water gushing out of it from seemingly nowhere. The faucet remains surprisingly steady despite having no visible support and where is all this water coming from? This spectacular effect is achieved by a transparent tube in the middle of the water column that holds the tap in place and, at the same time, keeps feeding it with water pumped from below. The water goes up through the tube and exits at the top. The water column, which is usually turbulent, effectively hides the tube from view. The illusion works best when the supporting pipe is transparent.

Magical Tap model installed in science park

32. Law of conservation of energy (Newtons Craddle) - Law of conservation of energy states that the total amount of energy in an isolated system remains constant over time. The total

energy is said to be conserved over time. This gadget has swinging balls to prove law of conservation.

Newtons cradle installed in the science park

33. Perception of Depth

Look at the dismembered parts of the zebra. Look through the peep hole through one eye. What do you see? When the distance of an object changes, the relative sizes of the two images on retina also changes. This makes us feel what is far and what is near. With one image on one retina we lose the feeling of distance and everything appears in the same place.

Different dismembered parts of the zebra

Zebra as seen from the hole

Newly constructed gate in the science park

Geography – In geography the World Time exhibit purchased from Ankidyne Pvt Ltd., Chennai and installed in the Science Park Area.

34. WORLD TIME(CYLINDER TYPE) - The change in local time of every country, with reference to the latitude of that country is explained here.
Recommended Class:IV,V,VI.

WORLD TIME(CYLINDER TYPE) IN THE SCIENCE PARK

DNA MODEL IN THE SCIENCE PARK

35. DNA MODEL - **The components of DNA chain is explained here with labeling of Adenine, Thayamine, Cytocin, Guanine.**

Recommended Class: VIII, IX, X, XI, XII

**Centrifugal force model installed in the science park**

36. Centrifugal force - In Newtonian mechanics, the centrifugal force is an inertial force (also called a 'fictitious' or 'pseudo' force) directed away from the axis of rotation that appears to act on all objects when viewed in a rotating reference frame.

The concept of the centrifugal force can be applied in rotating devices, such as centrifuges, centrifugal pumps, centrifugal governors, and centrifugal clutches, and in centrifugal railways, planetary orbits, banked curves, etc. when they are analyzed in a rotating coordinate system.

The forces governing centrifugal force are explained with fun filled merry go round.

Recommended Class: 8th, 9th, 10th
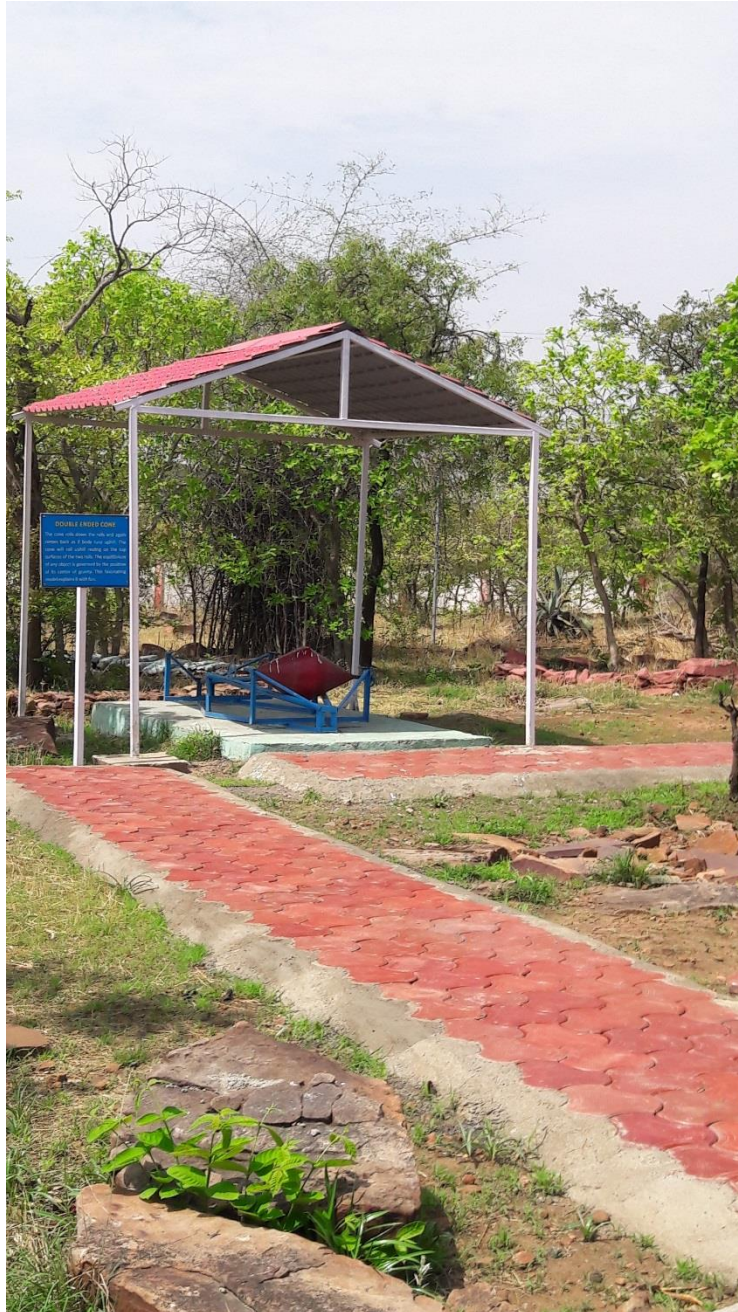
Double Ended Cone model installed in the science park

37. Double Ended Cone (Body Runs Uphill) **-** This exhibit consists of a double cone and two inclined rails on which the cone can roll. The cone rolls down the rails and again comes back as if body runs uphill. The cone will roll uphill resting on the top surfaces of the two rails. The equilibrium of any object is governed by the position of its center of gravity. This fascinating model explains it with fun.

Recommended Class: 7th, 8th, 9th

Students of B.Sc. B.Ed. IIIrd Sem working with the double cone model

38. Musical Bars – Tubes of different length are hanging. Relationship between pitch of sound and length of tube is demonstrated in the exhibit. Picture below shows the exhibit installed in the science park area.

Recommended Class: 6th, 7th, 8th

39. Bird in a Cage – This exhibit consists of a revolving plate having a parrot on one side and a cage on other side. Persistence of vision is the phenomenon of the eye by which an afterimage is thought to persist for approximately one twenty-fifth of a second on the retina. This property of retina is utilized in making motion picture. Here is a gadget that exhibits the concept of motion picture, where one side of the frame has a picture of a bird and other side has a bird cage, when this frame is rotated in high speed, we will visualize a picture as if the bird is inside the cage. The retina holds an image for $1/16^{th}$ of a second. If another image falls on the eye during this period the image gets mixed up. Here the bird appears to be inside the cage.

Bird in a Cage model installed in science park

40. Planck's Law

Planck's law describes the amount of electromagnetic energy with a certain wavelength radiated by a black body in thermal equilibrium (i.e. the spectral radiance of a black body). The law is named after Max Planck, who originally proposed it in 1900

Recommended Class: 8th, 9th, 10th

41. Friction and Speed:- Description: Velocity is a vector quantity that has both magnitude and direction. Any change in magnitude or direction leads to change in velocity that is explained using the gravity ball.

Recommended Class: 5th, 6th, 7th, 8th

42. Cycloid Path

The principle that cycloid path is the shortest path of travel of any object has been demonstrated in the exhibit. When two similar balls travel in two different paths, one straight line path and another cycloidal path, the ball traveling through cycloidal path gains more acceleration due to gravity and reaches first. Picture below shows the exhibit installed in the science park area.

FLUID MECHANICS – In fluid mechanics Vortex model has been purchased from Ankidyne Pvt Ltd., Chennai and installed in the Science Park.

43. VORTEX : The rotating fluid subjected to centrifugal force creating funnel shaped formation like tornado.

44. Set of Levers- The lever is a simple machine consisting of a bar supported at some stationary point along its length and used to overcome resistance at a second point by application of force at a third point. The stationary point of a lever is known as its fulcrum. The principle of lever can be explained as when two equal forces acting in opposite directions, i.e., clockwise and anticlockwise, and applied to a uniform lever at equal distances from the fulcrum counteract each other and established a state of equilibrium, or balance, in the lever. First order levers have the turning point (fulcrum) between the load and the effort. The mechanical advantage gained

through a first order lever is illustrated with varying fulcrum distance from weight Recommended Class: 4th, 5th, 6th

Lever reduces our effort in lifting heavy weights. This principle has been demonstrated in the exhibit. The fulcrum position is changed in different levers and so the effort to lift the weights also changes. Picture below shows the exhibit installed in the science park area.

45. Archimedean Screw- This device was conceived by Archimedes for raising water to a given height. The Archimedes' screw, also called the Archimedean screw or screwpump, is a machine historically used for transferring water from a low-lying body of water into irrigation ditches. Centrifugal force utilized in ancient days for water lifting is explained in this exhibit.

The device has been installed in the water tank in Science Park area. Picture below shows the exhibit.

Recommended Class: 6th, 7th, 8th

46. Swinging Pendula – This is a simple exhibit to demonstrate the concept of simple harmonic motion. It gives the relation between length of a string and its time period/frequency. On moving the group of strings of different length the concepts of simple harmonic motion can be easily studied. Picture below shows the exhibit.

47. Inclined Planes – An inclined plane is a flat surface that lies at an angle relative to level ground used to form a ramp to raise and lower a load. The load can be as simple as a person, i.e. walking up a ramp, or larger such as trains hauling materials along a graded track. The steepness and length of the plane help to distribute weight and reduce work that is needed to lift or lower materials from one elevation to another. Equal weights are hung by different ropes. Inclined planes reduce the effort of lifting heavy weights. This principle has been demonstrated in the exhibit. Picture below shows the exhibit installed in the science park area.

Plantation done in the Science Park Area

Medicinal Plants nursery at Science Park

Civil work done in the Science Park Area

Fixing of paver blocks

For beautification and easy approach to the Science Park area, paver pathways have been constructed. Below are shown the images of the work done.

Image of paver block pathways alongwith solar street lighting system

Installation of Solar Panel and Street Lighting System

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W). The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 W module will have twice the area of a 16% efficient 230 W module.

A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.

Theory and Construction

Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones based on thin-film cells are also available. The cells must be connected electrically in series, one to another. Externally, most of photovoltaic modules use MC4 connectors type to facilitate easy weatherproof connections to the rest of the system.

Module electrical connections are made in series to achieve a desired output voltage or in parallel to provide a desired current capability. The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive transition metals. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated.

Some special solar PV modules include concentrators in which light is focused by lenses or mirrors onto smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way.

Solar panels also use metal frames consisting of racking components, brackets, reflector shapes, and troughs to better support the panel structure.
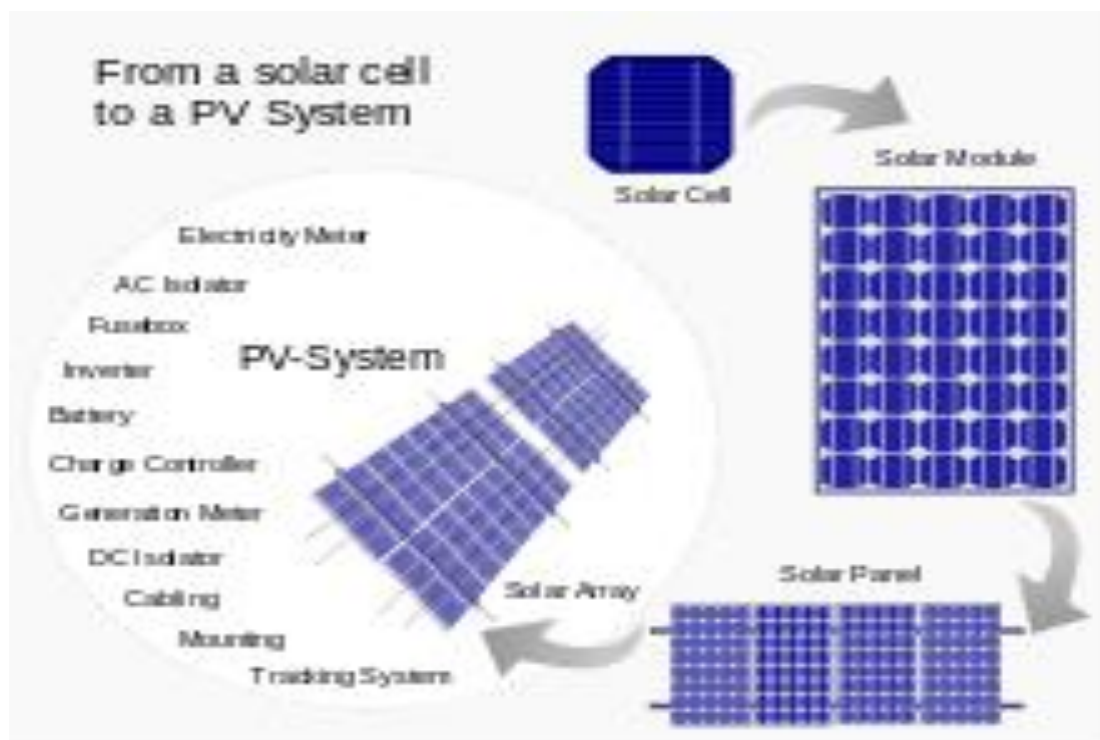
DETAILS OF SOLAR LIGHTING SYSTEM IN SCIENCE PARK AREA

Name of the Articles – SOLAR AUTOMETIC STREET LIGHTS	Unit	Quantity Required
(a) Emax Brand Luminary of SMD/LED with Aluminum Heat sink and Luminary with in-built dust to dawn system, charge controller for battery and SMD Driver. (b) Solar Tubular Battery of HBL Brand, 40 mah, 12 Volt. (Warranty: 5 Years) (c) Emax Brand Solar PV Module of 70 Watt. 12 Volt. (d) One set of Plastic Battery Box. (e) Fittings & Fixtures for battery Box, Luminary and SPV Module.	Nos.	06 (Six)

Name of the Articles – SOLAR PANNEL WITH LED TUBELIGHTS ALL OVER THE AREA OF SCIENCE PARK	Unit	Quantity Required
(a) S.PV. Modules of 250 W each	Nos.	09 nine
(b) Inverter 1000w each	Nos.	03 three
(c) Battery 40 mAh	Nos.	06 six
(d) L.E.D. Tube lights 20 W each with accessories	Nos.	40 forty

SOLAR PANEL INSTALLED IN THE SCIENCE PARK AREA

Future plans:- STEAM stands for STEAM, Technology, Engineering, Arts and Mathematics and STEAM pedagogy encompasses various activities which involve the integration of STEAM in the classroom. As we move from STEM to STEAM, the integration of arts in STEM has been done to improve student learning, creativity and competencies. STEM was coined by the NSF (National STEAM Foundation) in the USA two decades ago and since then STEM has gained much popularity and has proved to be an effective pedagogy in enhancing student learning and achievement To improve and inculcate the 21st Century skills among the learners, arts was added to STEM and this gave birth to STEAM. Hence STEAM education promises to inculcate among the learners problem solving through innovation, creativity, critical thinking, communication, collaboration and competencies required in the real world. As National Education Policy 2020 "no hard separations between arts and STEAMs, between curricular and

extra-curricular activities, between vocational and academic streams, etc. in order to eliminate harmful hierarchies among, and silos between different areas of learning"

STEAM Park will help to build child's natural curiosity and desire to create, explore, and investigate the world of early STEAM, science, technology, engineering, art, and maths (STEAM) through creative play. It will provide a natural and free environment for students to learn and familiarize with different scientific concepts. It will also provide innovative ways to communicate STEAM, learn STEAM to enthuse, entertain, initiate, excite and to know about the developments of STEAM and technology. The park will also attempt to enhance public understanding of STEAM and spread scientific literacy. It will also fulfill the need of Demonstration Multipurpose School in the RIE campus and societal needs.

Professional Development of Teachers- The key element of inculcating principles and perception of art integration lies in interest and surfacing their abilities to make them competent teachers. It is expected that on observing displays in the park confidence and innovation may be imbibed in the teachers.

Visit of school students and teachers at STEAM PARK RIE Bhopal

The main objective of STEAM (Science, Technology, Engineering, Arts and Mathematics) park is to provide STEAM learning environment to enable students for establishing connections on integration between science, technology, engineering, arts and mathematics. It provides an engaging atmosphere in the form of access points like working models, visual arts, charts, activities, puzzles etc. to engage students in the process of inquiry, dialogue, and critical thinking in the lines of STEAM. STEAM Park has been successful in building the child's natural curiosity and desire to create, explore, and investigate the world of science, technology, engineering, art, and maths (STEAM) through creative play. It provides a natural and free environment for students to learn and familiarize with different scientific concepts. The models displayed in the park allow children to play with an array of exhibits in science, technology, arts and mathematics. Medicinal Plant Garden also enriches the environment. It is a lifetime experience of learning for children while playing in the park. Around 200 students and 50 teachers visited the STEAM Park in the last academic year. They found the place to be innovative which effectively promotes design thinking among teachers and students. Students and teachers reported a wonderful and joyful experience visiting the park. They could understand different fundamental concepts of Science, technology, Engineering, Arts and Mathematics in an easy and interesting way through different models displayed in the park. They also learnt about different flora and fauna in the park area. Through each and every model they were immersed in experiences that allowed them to wonder and question, and then collaborate, create, and develop activities that they could take back to their schools and colleges. The entire experience for the students and teachers was invigorating, encouraging, and enlightening.

The students of the following schools visited the STEAM Park from February 20 to 24, 2022:

1. Govt. Kasturba H.S. School Bhopal
2. Govt. Girls H.S. School Jehangirabad Bhopal
3. Sarojini Naidu Govt. Girls H.S. School Bhopal
4. CM Rise Kamla Nehru Girls H.S. School Bhopal.

Govt. Kasturba H.S. School Bhopal students visiting the STEAM Park and observing several models

Govt. Kasturba H.S. School Bhopal students visiting the STEAM Park and observing several models

Interaction of the faculty members with the students on visit of STEAM Park

Visit of Honorable Director NCERT, Prof. Dinesh Prasad Saklani to STEAM Park

Honorable Director NCERT, Prof. Dinesh Prasad Saklani visited the STEAM Park on 15/04/2022 and inaugurated the QR code facility. It was a moment of great pride and joy for all the faculty members.

Honorable Secretary NCERT visited the STEAM Park on 111/02/2023