

3.1.4 Report of innovations tried out and ideas incubated

Being a premiere institute in teacher education in the country under NCERT, the institute always tries to promote novel ideas with regard to research in the field of school education and teacher education. Besides getting the ideas from national and international experts relating to various areas of school education and teacher education in content, pedagogy and technology, the institute has its own mechanism in promoting novel ideas. All these innovative ideas are tried out and incubated. Various experiments are made by the pre-service, In-service teachers with the help of the teaching learning resources available in the Institute such as the theme park, botanical garden, resource center available in the Institute. These resources are created in order to enable researchers to think of new ideas. A report relating to the significance and activities in theme park is attached here. Another novel idea which was promoted during this period in the Institute is the adoption of Chilika block for promoting school education and teacher education in 11 clusters of the block. All innovative pedagogical practices such as art-integrated learning, toy based pedagogy and sports integrated learning were adopted in the programme to enhance the achievement level of students and teachers in the block during this period. Report of this novel idea is attached here.



Regional Institute of Education

(National Council of Educational Research and Training)

Bhubaneswar -751022, Odisha



EDUCATIONAL THEME
PARK

Activity-1

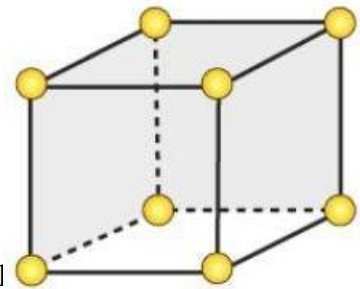
CRYSTAL STRUCTURE

Most solids are made of crystals. The three-dimensional arrangement of atoms, molecules or ions inside a crystal is known as crystal lattice. A unit cell, is the building block of a crystal lattice, the smallest repeating units of the crystal lattice.

There are three types of unit cell:

- (a) **Primitive or Simple Cubic Unit cell:** The simplest repeating unit in SCC (Simple Cubic Unit Cell) is shown in Figure. Each corner of the unit cell is defined by a lattice point at which an atom, ion or molecule can be found in the crystal. Every atom at the corner is shared among 8 adjacent unit cells. It is an open structure.

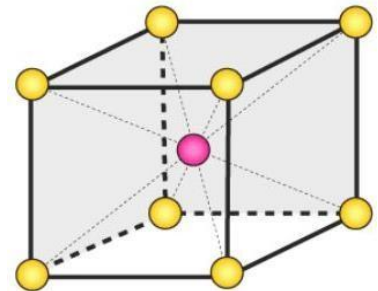
There are 8 atoms at the corners. The total number of atoms in one unit cell example of SCC unit cell is Polonium.



- (b) **Body-Centred cubic unit cell:** The simplest repeating unit in BCC (Body-centred cubic unit cell) is shown in Figure. In this structure there are eight identical particles on the eight corners of the unit cell and one at the centre of the body of the unit cell. It is an open structure.

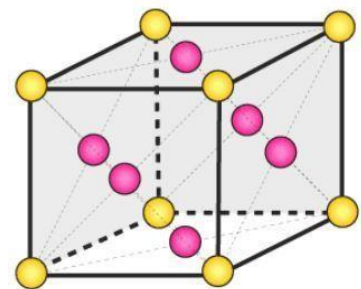
The total number of atoms in one unit cell is: $8 \times 1/8 + 1 = 2$ atom.

An example of BCC unit cell is Iron, Chromium and Tungsten.



- (c) **Face-Centred Cubic Unit Cell:** The simplest repeating unit in FCC (Face-centred Cubic Unit Cell) is shown in Figure is a closest-packed structure. It contains atoms at all the corners of the crystal lattice and at the centre of all the faces of the cube. The atom present at the face-centred is shared between 2 adjacent unit cells and only $1/2$ of each atom belongs to a cell.

The total number of atoms in one unit cell: $8 \times 1/8 + 6 \times 1/2 = 1+3 = 4$ atom. An example of FCC unit cell is Copper, Gold and Aluminum.



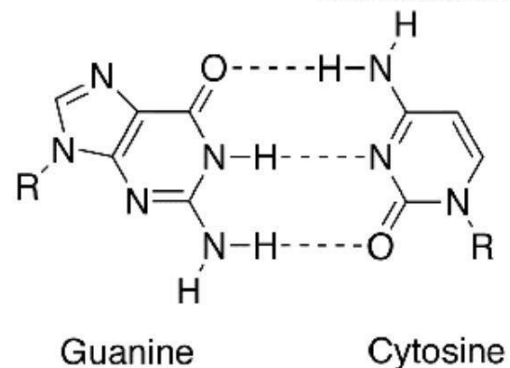
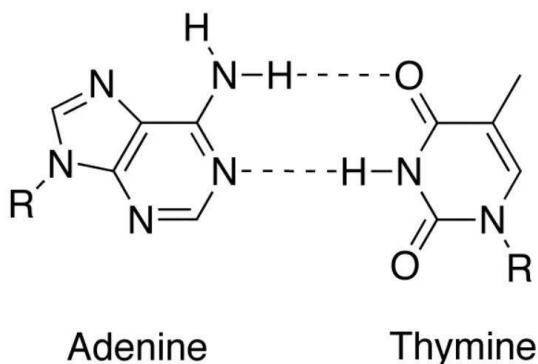
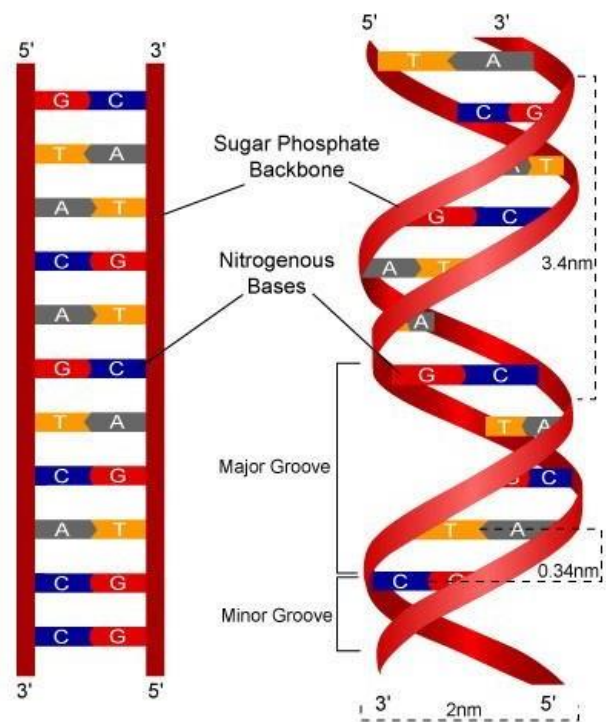
Activity-2

DNA

Nucleic acids are the organic material present in all organism in the form of DNA or RNA. These nucleic acids are formed by the combination of nitrogenous bases, sugar molecules and the phosphate group that are linked by different bond in a series of sequences. DNA, deoxyribonucleic acid, organic chemical of complex molecular structure that is found in cells and viruses.

DNA is made up of molecules called nucleotides. Each nucleotides contains a phosphate group, a sugar group and anitrogen base. The four types of nitrogen bases are Adenine (A), thymine (T), guanine (G) and cytosine (C).

Nucleotides are attached together to form two long strands that spiral to create a structure called a double helix. If you consider a double helix as a ladder, the phosphate and sugar molecule would be the sides, while the bases would be the rungs.



Activity-3

EVOLUTION OF HUMAN BEING

Human Evolution is the lengthy process of change by which people originated from ape- like ancestors. Scientific evidence shows that the physical and behavioral traits shared by all people originated from apelike ancestors and evolved over a period of approximate sixmillion years.

According to the Scientist Charles Darwin (1809-1882), evolution depends on a process called natural selection. The theory emphasized the points of Natural selection, Variation,Struggle to exist, Survival of the fittest.

Stages in Human Evolution

(a) Dryopithecus

Historical Epoch – 2,50,00,000 years ago

Size and Weight – About 4 feet long and 25 Pounds

Characteristics – Small body, Small Head, Strong Teeth, Front coming Jaw, Lowdeveloped Eyebrow

(b) Ramapithecus

Historical Epoch – 1,00,00,000 years ago

Size and Weight – About 5 feet long and 50-70 Pounds
Characteristics – Upright Posture, Use hands for food and defense

(c) Australopithecus

Historical Epoch – 40,00,00 years ago

Size and Weight – About 4 feet long and 60-90 Pounds
Characteristics – Use Stones as Weapons to hunt small animals

(d) Homohabilis

Historical Epoch – 20,00,00 years ago

Size and Weight – About 5 feet long and 80-100 Pounds
Characteristics – May be able to speak, first to make and use tool

(e) Homoerectus

Historical Epoch – 15,00,00 years ago

Size and Weight – About 4.5-6 feet long and 90-140 Pounds

Characteristics – Upright, Long Face, Large Brain, Prominent Speech, Make and Usetools, Made fire, Carnivorous

(f) Homosapiens

Historical Epoch – 1,50,00 years ago

Size and Weight – About 5-5.5 feet long and 130-175 Pounds

Characteristics – Larger brain, head and jaw, Powerful and muscular hunter, Cavedwell

Activity-4

MASS & INERTIA

Newton's first law of motion states that "An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force." The tendency to resist change in their state of motion is described as inertia.

All objects resist changes in their state of motion. All objects have this tendency- they have inertia. But do some objects have more of a tendency to resist changes other than others?

Absolutely Yes!!

The tendency of an object to resist changes in its state of motion varies with mass. Mass is that quantity that is solely dependent upon the inertia of an object. A more object has a greater tendency to resist changes in its state of motion.

EXAMPLE:

A truck is transporting a huge stone. While the truck is in motion, the stone is also in motion. A deer suddenly jumps into the road and the driver slams the break. The truck stops but the stone moves forward because the stone, which is in motion, fights to stay in motion.



Activity-5

PYTHAGORAS THEOREM

Pythagoras theorem states that “In a right-angled triangle, the square of the hypotenuse side is equal to the sum of squares of the other two sides”.

The sides of this triangle have been named as Perp. (Perpendicular), Base and Hypotenuse. The hypotenuse is the longest side and it's always opposite to the right angle.

$$c^2 = a^2 + b^2$$

PROOF:

We know, $\triangle ADB \sim \triangle ABC$

Therefore, Corresponding sides of similar triangles

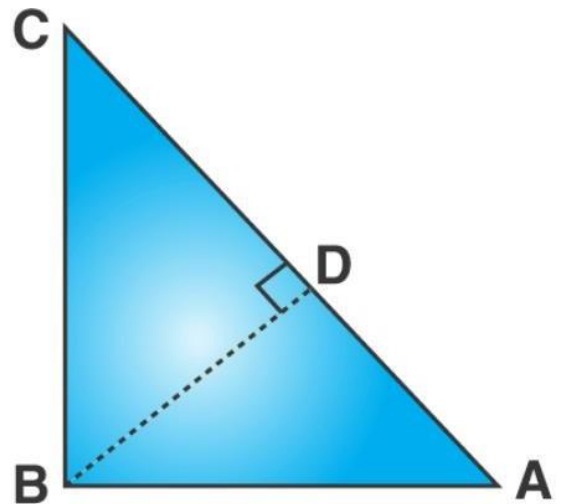
$$\frac{AD}{AB} = \frac{AB}{AC}$$

$AB^2 = AD \times AC$ Also,

$\triangle BDC \sim \triangle ABC$

Therefore, Corresponding sides of similar triangles

$$\frac{CD}{BC} = \frac{BC}{AC}$$



$$BC^2 = CD \times AC$$

Adding

Therefore, Corresponding sides of similar triangles

$$\frac{AD}{AB} = \frac{AB}{AC}$$

$$AB^2 + BC^2 = AD \times AC + CD \times AC$$

$$AB^2 + BC^2 = AC(AD + CD)$$

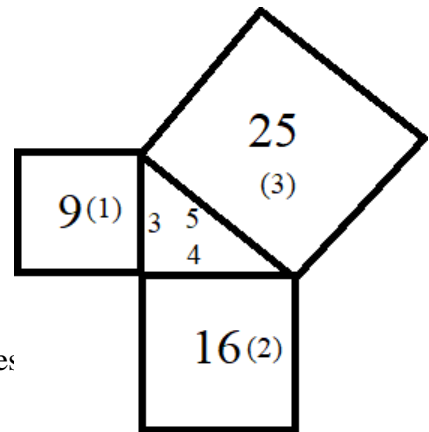
$$AD + CD = AC$$

$$AB^2 + BC^2 = AC^2$$

We can determine whether the triangle shown is a right triangle.

Area of square (1) + Area of square (2) = Area of square (3)

If it is true, then the triangle formed by the sides of these squares will be a right angle triangle.



Activity-6

SOLAR SYSTEM

The Solar System is made up of the sun and everything that orbits around it, including planets, moons, asteroids, comets and meteoroids. The Sun is by far the largest object in our solar system, containing 99.8% of the solar system's mass. It sheds most of the heat and light that makes life possible on Earth and possibly elsewhere. Planets orbit the sun in oval-shaped paths called ellipses, with the sun slightly off-center of each ellipse.

Inner solar system

The four inner planets — Mercury, Venus, Earth and Mars — are made up mostly of iron and rock. They are known as terrestrial or earth-like planets because of their similar size and composition. Earth has one natural satellite — the moon — and Mars has two moons — Deimos and Phobos.

Between Mars and Jupiter lies the Asteroid Belt. Asteroids are minor planets, and scientists estimate there are more than 750,000 of them with diameters larger than three-fifths of a mile (1 km) and millions of smaller asteroids.

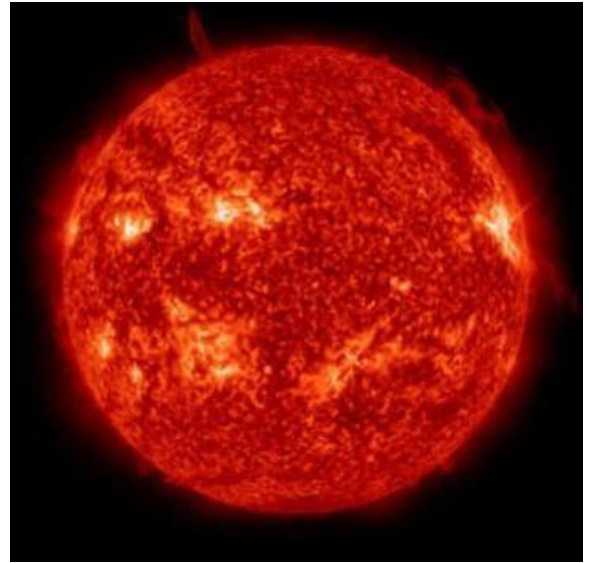
Outer solar system

The outer planets — Jupiter, Saturn, Uranus and Neptune — are giant worlds with thick outer layers of gas. Between these planets, they have dozens of moons with a variety of compositions, ranging from rocky to icy to even volcanic. Nearly all the planets' mass is made up of hydrogen and helium, giving them compositions like that of the sun.

SOME FACT ABOUT MEMBERS OF SOLAR FAMILY

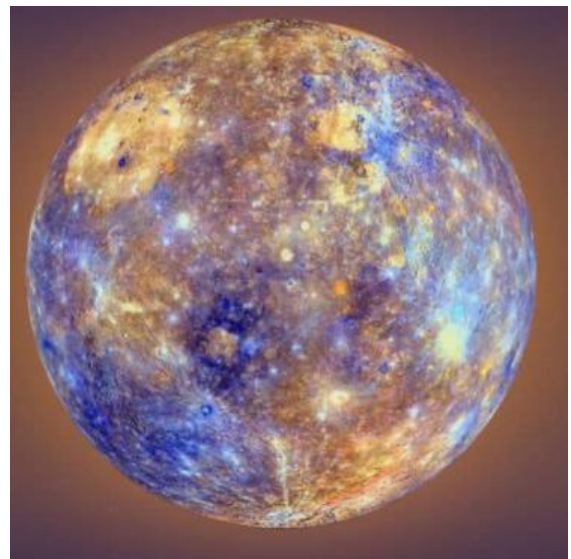
1. SUN

- Located in the center of Solar System
- Diameter around 1.39 million Km
- 109 times greater than diameter of our Earth
- So massive that it has 99.86% mass of the entire solar system.
- Sun completes its one orbit around the Milky way in around 230 million years.
- At equator, sun spins once every 25 days, while at poles, it rotates once every 35 days.
- Sun's true color is White.



2. MERCURY

- Smallest and Closet planet to the Sun – 57 million Km.
- Densest planet in the solar system after Earth.
- It has diameter of 4.879 Km.
- During the day, mercury average surface temperature reach up to 430⁰ C but at night the average temperature reach up to -180⁰C.
- One day on mercury is 59 Earth days.
- It circles the sun once every 88 Earth days.
- First spacecraft to explore Mercury was NASA's Mariner 10.



3. VENUS

- Second planet from the Sun, Distance
 - 108 million Km.
- Hottest planet of the Solar system, 62degree hotter than Mercury. Averagetemperature during day is 465°C
- It has diameter of 12.104 Km.
- One day on Venus is 243 Earth days and one year is equals to 225 Earth days.
- Due to its brightness it is also known as morning & Evening Star.
- First spacecraft to explore Venus wasMariner 2



4. EARTH

- Third planet from the Sun, Distance
 - 149 million Km.
- Earth rotates around sun is 365.25days.
- It has a diameter of 6.371 km.
- One day on Earth is 23.9 hours.
- Moon is the natural satellite of Earth.
- Light reach us from the sun in about8 minutes.
- First image of earth taken from spaceis happened on 24th October 1946.



5. MARS

- Mars is the fourth planet from the sun, Distance – 227.9 million Km.
- Two times smaller than Earth, Diameter -6.779 Km
- Two natural satellites – Phobos & Deimos.
- Average temperature on Mars is -60°C.
- A day on Mars is little longer than a day on Earth – 24.6 hour.
- A year on Mars is almost twice as long as a year on Earth.
- The first spacecraft to visit Mars was Mariner 4.

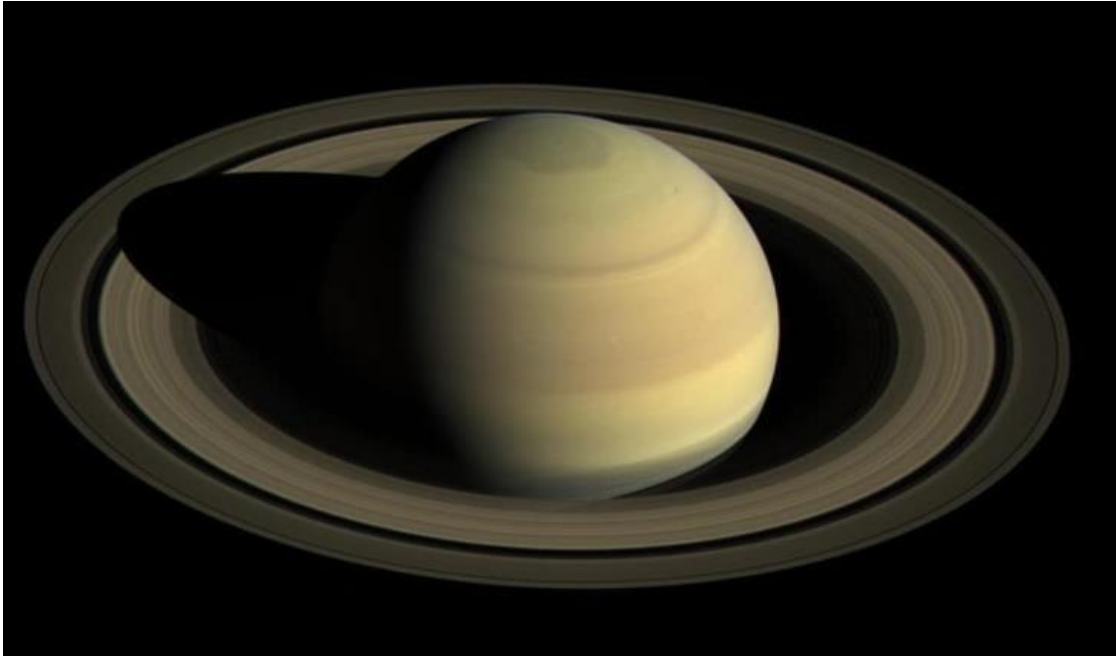


6. JUPITER

- Jupiter is fifth planet from the sun, Distance – 778.5 million Km.
- Total 79 confirmed natural moon.
- Largest planet in the Solar system with diameter at equator 142.984 km and at poles 133.708 km.
- A day on Jupiter goes very fast, only last for 10 hours.
- It takes 11.8 Earth days to circle the sun once.



7. SATURN



- Sixth planet from the sun, Distance – 1.434 billion Km.
- Second Largest planet having diameter 120.536 Km.
- 82 confirmed natural satellite (moon).
- Temperature on average in upper atmosphere is -175°C .
- Named as “Ringed planet” – 30 ring system around it.
- A day goes very fast here – only 10.7 hours.
- It takes 29 Earth years to orbit the sun once.
- Some spacecraft that visited Saturn are Pioneer 11, Cassini and Voyager 1 and 2.
- Saturn is lighter than water, So that if you place Saturn in a ocean, it would float.

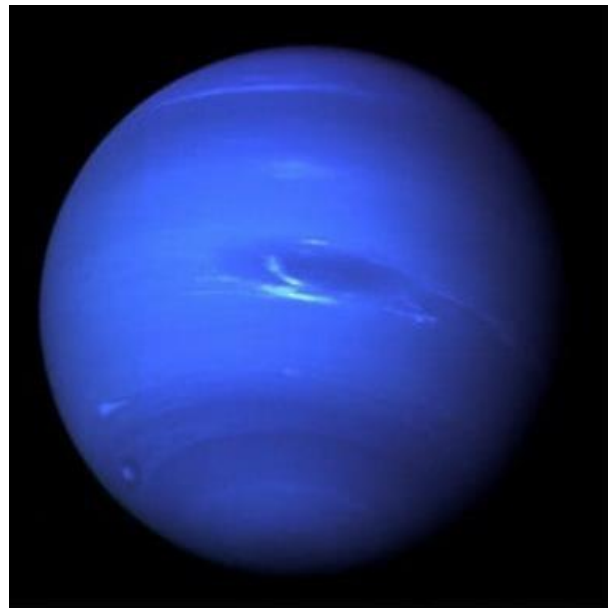
8. URANUS

- Seventh planet from the sun. Distance – 2.871 billion Km.
- Third largest planet of solar system having diameter 51.118 Km.
- It rotates in opposite direction than most planet.
- Average temperature is around -224°C
- It also has rings (13) but difficult to observe.
- Uranus has 27 moons orbiting it.
- One day lasts 17 hours while one year of Uranus is 84 Earth years.
- It only once visited by Voyager 2.



9. NEPTUNE

- It is the farthest planet in solar system, distance -4.495 billion Km.
- It has a diameter of 49.244 Km.
- Wind speed on Neptune is the fastest recorded in the solar system.
- Average surface temperature is -214°C .
- It has 14 moons.
- A day on Neptune lasts for 16 hours while a year is equivalent to 165 Earth years.
- It only once visited by Voyager 2.



Activity-7

VORTEX

A vortex is a physical phenomenon that occurs when a gas or a liquid move in circles. At the center is a vortex line that the matter swirls around. They are formed when there is a difference in the velocity of what surrounds the line. Hurricanes, tornadoes and air moving over a plane wing are example of vortices.

In short, A vortex is fluid that revolves around the axis line. This fluid might be curved or straight. Vortices form from stirred fluids: they might be observed in smoke rings, whirlpools, in the wake of a boat or the winds around a tornado or dust devil.

EXAMPLE:



Activity-8

WORLD GLOBE TIME

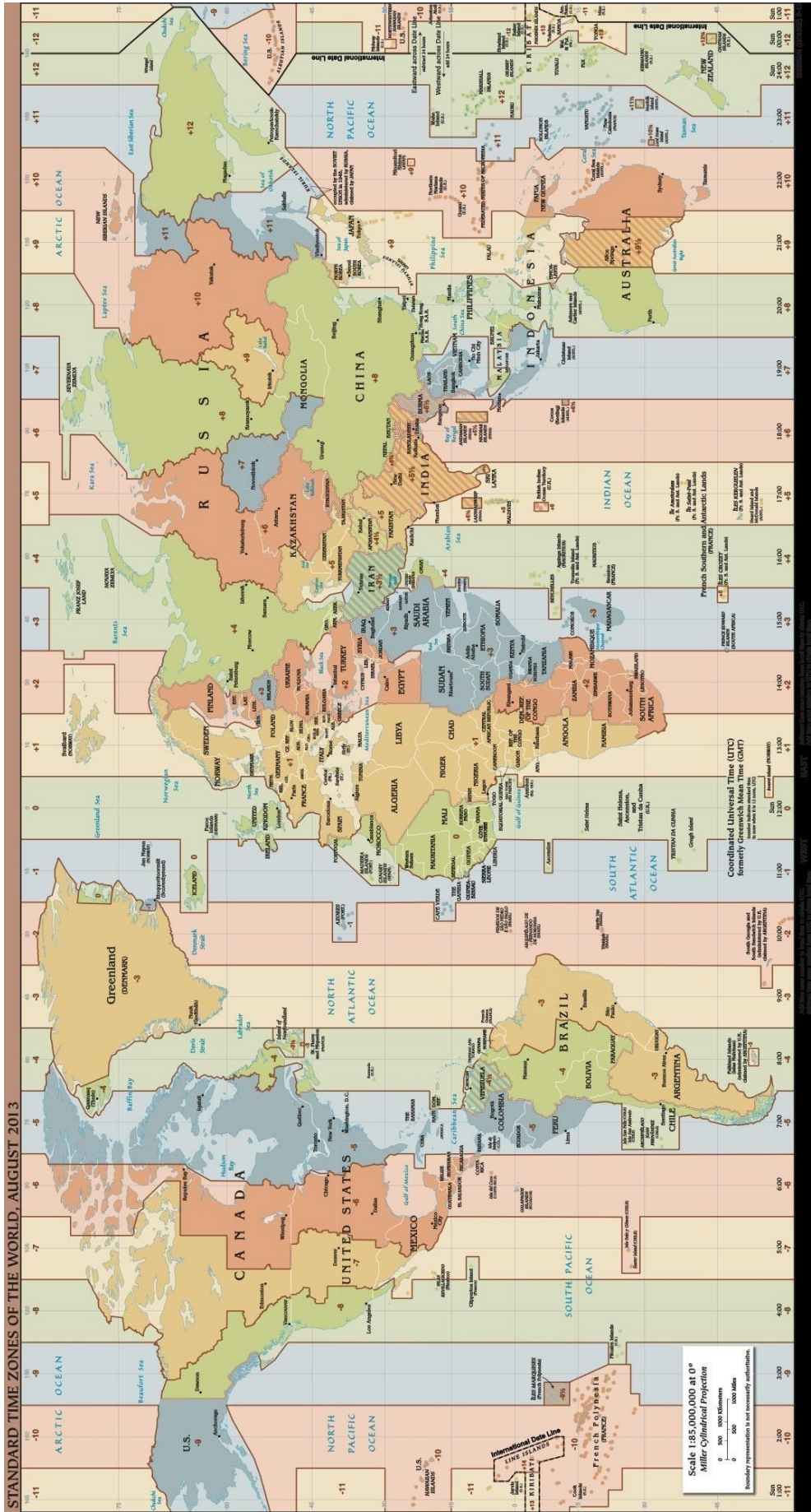
Time zones give specific area on the Earth a time of day that is earlier or later than the neighboring time zones. This is because when it is daytime on one side of the earth, it is nighttime on the other side. A time zone is a region where the same standard time is used. The local time within a time zone is defined by its offset from Coordinated Universal time (UTC), the world's time standard.

Time zone are a geographical world globe division of 15° each, starting at Greenwich, in England, created to help people know what time is it now in another part of the world. The earth has been divided into 24 time zones of one hour each. Each zone thus covers 15° of longitude. GMT began in 1675.

HOW TO CALCULATE?

The earth rotates 360° in about 24 hours, which means 15° an hour or 1° in four minutes. Thus, when it is noon at Greenwich, the time at 15° east of Greenwich will be $15 \times 4 = 60$ minutes, i.e., 1 hour ahead of Greenwich Time, but at 15° west of Greenwich, the time will be behind Greenwich Time by one hour.





Implementation of NCERT Interventions at School Stage: A Journey of Research in Chilika Block, Odisha



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Acknowledgement

Elementary education is vital for children as well as for society as a whole. It laid the foundation for learning besides fostering deep interest among the children. In order to achieve the quality of learning at elementary level, Regional Institute of Education, Bhubaneswar has adopted all the elementary schools of Chilika block in Khordha district of Odisha, since 2019, to provide NCERT interventions at grass root level. Implementation of NCERT interventions at elementary school stage was taken up in Chilika block with the cooperation and support of Government of Odisha.

The team members of RIE, Bhubaneswar are grateful to the Principal Secretary, Government of Odisha for his kind permission to undertake the study in Chilika block. We are thankful to SPD, OSEPA, Odisha, Director, TE & SCERT, Collector, Khordha, DEO, Khordha, BDO, Chilika Block, Chairman, Chilika Block, PRI members, all elementary students of Chilika Block, SMC members, Parents, BEO, ABEO, CRCCs, Teachers and Head Teachers of Chilika block for their support and co-operation throughout the implementation of the programme.

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Prof. P. C. Agarwal
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List of Acronyms

- BEO - Block Education Officer
- ABEO - Assistant Block Education Officer
- BRCC - Block Resource Centre Coordinator
- CRCC - Cluster Resource Centre Coordinator
- BDO - Block Development Officer
- DEO - District Education Officer
- DIET - District Institute of Education and Training
- DPC - District Project Coordinator
- KRP - Key Resource Person
- NCERT - National Council of Educational Research and Training
- NCF - National Curriculum Framework
- NEP - National Education Policy
- PRI - Panchayati Raj Institution
- PSQ - Personal Social Qualities
- PTR - Pupil Teacher Ratio
- RTE - Right of Children to Free and Compulsory Education
- SCERT - State Council of Educational Research and Training
- SMC - School Management Committee
- SPD - State Project Director
- SSA - Sarva Shiksha Abhiyan
- OSEPA - Odisha State Education Programme Authority

Executive Summary

Implementation of NCERT Interventions at Elementary School Stage: A Journey of Research from 2019 to 2022 in Chilika Block, Odisha for Enhancing Quality of Elementary Education

Rationale of the Study

The National Council of Educational Research and Training in its PAC meeting in the year 2018-19 discussed about the adoption of a block in the state where RIEs are located. Accordingly, Director, NCERT wrote a letter to Commissioner cum Secretary, School and Mass Education Department, Govt. of Odisha to suggest a rural block for adoption by RIE, Bhubaneswar to provide the academic interventions, to bring out quality change in learning levels among the learners. Bringing quality of school education in the country is the mandate of NCERT. On this basis, there was a discussion with the Director of TE and SCERT, Govt. of Odisha to finalize and select a rural block of Khordha district for academic intervention. After threadbare discussion with the authorities of Govt. of Odisha, it was decided to select the Chilika rural block of Khordha District for academic intervention. Thereafter, NCERT approved the proposal and decided to choose all the elementary schools of Chilika Block for providing NCERT interventions towards improving quality of teaching and learning processes at Elementary stage. Afterwards a joint meeting was organized with BRCC, CRCCs, BEO, ABEO, HM, BDO, DPC, SSA functionaries, community members, faculty members of RIE at Chilika Block head quarter, (Gangadharpur) on 12.10.2018. Director, NCERT, ADM, Khordha, Director SCERT were also present in the meeting. In the meeting there was a discussion about the adaptation of schools in the block and future course of action to improve capacity building of the teachers in order to help to improve quality in learners learning at elementary stage.

National Council of Educational Research and Training (NCERT), the apex body in school education in the country has always been engaged in developing various kinds of learning resources for teachers, teacher educators and learners. Since its inception, NCERT has been engaged in developing various kinds of learning resources for teachers, teacher educators and learners. Included among these are study materials (print-textual, supplementary etc.) for students, kits in science and mathematics, language, social sciences etc.; capacity-building programme for teachers and teacher educators in diverse areas, e.g. science and mathematics, environmental sciences, social sciences, languages, inclusive classroom environments, art integrated education, guidance and counseling, integration of Information and Communication Technology (ICT) in teaching-learning process.

Several need-based in-service training programmes have been organized for teachers and teacher educators to equip them with the skill-based competencies to help children in achieving their all-round development to bring educational growth of the school-going children and enhancing quality in

education. However, the above activities are undertaken by NCERT and its constituent units mostly at the macro level. The impact of these NCERT interventions for improving the quality of education, particularly in public sector, is often seen as marginal at the grass root level. In this context, Chilika Block of Khordha District (a rural block in the state of Odisha) has been undertaken for the purpose of conducting different programs and innovations since the year 2018-19. In the present study effects of various NCERT interventions have been studied in terms of its significant contributions on the holistic development of learners, including improving learning outcomes of students in different subject areas.

Before giving intervention in the Chilika Block, it was decided to have need assessment survey of the teachers/ head teachers/ CRCCs and BRCCs to find out the ground realities along with the level of learning outcomes of the learners at elementary stage. Need Assessment Interview of 237 teachers and CRCCs / BRCCs were taken and the responses were analyzed to find out the needs of the teachers of Chilka Block. Realizing to their needs, Capacity Building Programme was organized. All the 420 elementary teachers of Chilka block participated in the training programme. The training programmes covered almost all aspects of NCERT promoted interventions like- NCF guidelines, Curriculum, textbook & Inclusive education, learner-centered pedagogy for quality education, Learning Outcomes, PSQ & Well Being, ICT in Education, Pedagogy of Language, Pedagogy of EVS, Pedagogy of Social Science, Pedagogy of Science, Pedagogy of Mathematics, and use of Mathematics kits, use of science kits, School leadership for quality education, School-based assessment and Pedagogy of early childhood education etc.

Similarly in the first instance, after receiving the Competency based achievement test from Class-I to VIII from NCERT Head Quarter, translation of the tools were done from English to Odia. For conducting the baseline test an orientation programme was organized at RIE, Bhubaneswar and subsequently at Chilika block for all the teachers. A baseline competency based achievement test was also conducted from Classes I to VIII to access the level of learning before intervention. Background data of all the students, teachers and schools were collected by using Pupil questionnaire (PQ), Teacher questionnaire (TQ) and School Questionnaire (SQ).

During the mid-way of the project, Director (NCERT), Dean(R) (NCERT), Dean (C), NCERT & Head, PMD along with State Level Officials, Principals of all RIEs and other faculty members of RIE, Bhubaneswar visited Chilika Block to realize/ascertain the situation and provide on-site support. Further, faculty members of the institute also visited their respective allotted cluster(s) to provide onsite support besides collecting data from the school, teachers, community members, students etc., through observation and interviews. Further a case study report of each cluster was also prepared.

As per the 2011 census data of Chilika block, the literacy rate stands at 70%. The need assessment result of teachers highlighted that there is a need to improve the pedagogical and professional competencies of the teachers and giving more stress on activity based teaching besides putting emphasis on integration of ICT as a tool in learning.

The present study aims at integrating all these dimensions and implement those at the elementary school stage in Chilika rural revenue block of Khordha district of Odisha to assess the effects of interventions in bringing improvement in the functioning of the teacher in teaching-learning process, besides student's level of learning for their holistic development.

However, the outbreak of coronavirus pandemic has generated changes in the teaching-learning process from school education to higher education and has influenced the interaction between teachers and students in the academic session 2019-2020. As a consequence of the pandemic, schools were constrained to carrying out their activity with students in face-to-face mode. Consequently, online teaching learning process was adopted to reach with each and every elementary student to maintain continuity in teaching learning process. In order to explore the ongoing status of teaching-learning activities in schools and assess the effectiveness of online learning during pandemic, a survey was conducted.

Although online classes were conducted as per the guidelines of Govt. of Odisha, it was not seen to be very fruitful for all segments of learners in the block. As a result, students developed hard-spots in different subjects. In view of this, BEO, BRCs, CRCCs and all HMs suggested to conduct capacity building programmes for KRPs in RIE, Bhubaneswar on different hard spots of students and teachers using competency-based pedagogy. Thereafter, planning was made to organize capacity building of the teachers in order to facilitate the levels of learners learning at elementary stage, in accordance with the hard spots provided by the teachers. Capacity building programme was held at RIE, Bhubaneswar, for five days, for KRPs of the Chilika Block. Thereafter, such capacity building programme was also organized in face-to-face interaction mode, at all cluster-level hubs of Chilika Block, for all elementary teachers of the block. The training programmes covered almost all aspects of NCERT promoted interventions and identified hard spots. At the end of the academic session 2021-2022 post test was conducted. Before conducting the post-test, an orientation programme was organized at Chilika block through online mode, for all the CRCCs, who, in turn provided orientation to the teachers. A competency-based achievement post-test was conducted from Classes I to VIII to assess the learning performance of elementary students to find out the impact of intervention.

This document is the outcome of a study conducted in the Chilika Rural Block during the session 2019-2020, 2020-2021 and 2021-2022 to find out the teachers' perception and learning levels of the elementary students. The details activities undertaken during the research journey are given below:

**Table-1.1: Year-wise List of activities undertaken in the Block
Year 2019-20 (Pre Intervention Phase)**

Sl. No	Activities
1.	Initiation of the Project: Meeting with Govt of Odisha and NCERT/ RIE, Bhubaneswar at Chilika Block to improve quality of learning in the adopted Chilika Block elementary schools.
2.	Planning meeting with key stakeholders of school education i.e. BEO, ABEO, BRCs, CRCCs, HMs, BDO, DPC & SSA functionaries and SMC members with RIE faculty members.
3.	Collection of background data of Chilika Block.
4.	Baseline achievement survey of classes I-VIII in all the schools of all clusters of the Chilika block
5.	Preparation of baseline achievement survey report depicting the learning levels of students and different stakeholders(teachers/parents/community members) perceptions/ expectation about training and existing facilities in the cluster/schools

Year 2020-21 (Intervention Phase)

Sl. No.	Activities
1..	Five-day online capacity building programme of elementary School teachers of Chilika block, on various hard-spots.
2.	On-Site support through Case studies of clusters by faculty members of RIE, Bhubaneswar.
3.	Organizing Guidance and Counselling exhibition, Multi-cultural placement, Internship and Working with Community programme in Chilika Block.
4.	Report on extensive survey of different stakeholders about online teaching learning process during pandemic situation.

Year 2021-2022 (Post Intervention Phase)

Sl. No	Activities
1.	Four-day Capacity building programme of KRPs of Chilika Block.
2.	Three-day Capacity building programme of elementary School teachers of Chilika block with focus on specific hardspots in Science, Social Sciences, Mathematics and Language, by using the recommendations of NEP-2020.
3.	Intensive survey about the teaching and learning process and other related activities during Pandemic situation by investigators.
4.	Post-test of all elementary students of Chilika block and preparing comparative report