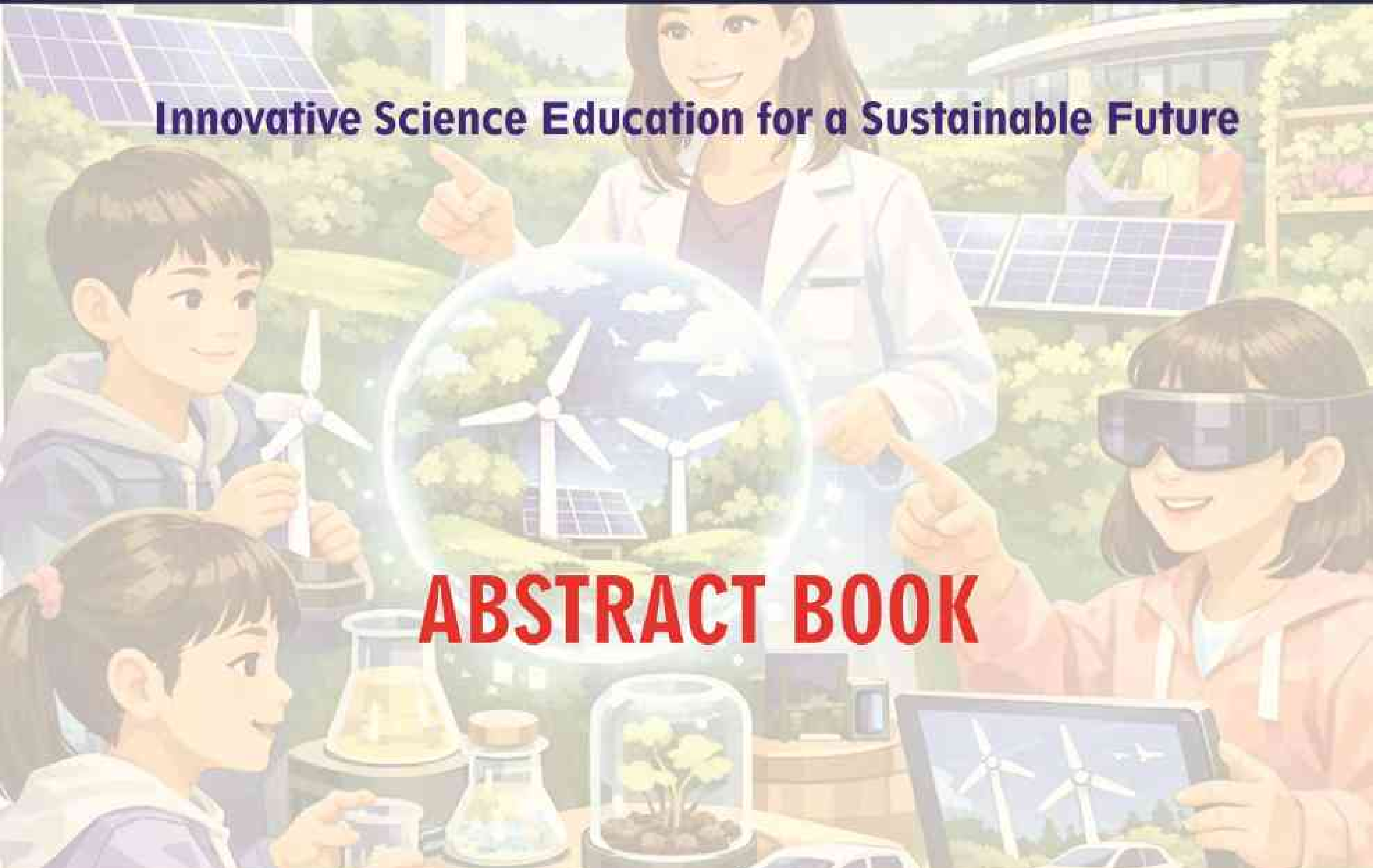
3-Day State Level Science Congress for Teachers and Researchers

March 24-26, 2026



Innovative Science Education for a Sustainable Future

ABSTRACT BOOK

MANIPUR SCIENCE & TECHNOLOGY COUNCIL

(An autonomous body of the Dept. of Science & Technology, Govt. of Manipur)

Science & Technology Complex, Takyelpat, Imphal

3-DAY STATE LEVEL SCIENCE CONGRESS FOR TEACHERS AND RESEARCHERS

March 24-26, 2026

Theme :

Innovative Science Education for a Sustainable Future

ABSTRACT

Supported by:

Department of Science & Technology
Govt. of Manipur

Organised by :

MANIPUR SCIENCE & TECHNOLOGY COUNCIL

(An autonomous body of the Dept. of Science & Technology, Govt. of Manipur)

Science & Technology Complex, Takyelpat, Imphal

Phone: 0385-2443451; e-mail: mastec@nic.in

Website: https://mastec.nic.in

Kengoo Zuringla, IAS
SECRETARY (SC & TECH)
Government of Manipur

सत्यमेव जयते

Manipur Secretariat
North Block
Imphal - 795001, Manipur
email: kengoo.zuringla@nic.in

Message

I am delighted to learn that an abstract book is being published on the event of the 3-Day State Level Science Congress for Teachers and Researchers which is being organized by the Manipur Science & Technology Council (MASTEC) and supported by the Department of Science and Technology, Government of Manipur from March 24–26, 2026.

Centered on the theme 'Innovative Science Education for a Sustainable Future,' this congress serves as a unique collaborative platform. It brings together a vibrant community of high school and higher secondary teachers, researchers in science education, science popularization activists, and vocational educators to reform and revitalize science education by bridging the gap between classroom teaching and real-world scientific practice.

The abstracts include both literature and original research in science education reflecting the dedication of our educators and specialists. By bridging the gap between theory and practice, this collection underscores our collective commitment to fostering a scientific temperament across Manipur.

May this 3-day congress be a truly successful and enriching experience for all participants.

Kengoo Zuringla, IAS
Secretary (S&T)
Govt. of Manipur

Ng. Bhogendra Meitei
Director Education (S)
Govt. of Manipur.

सत्यमेव जयते

Message

It gives me great pride and joy to congratulate the **Manipur Science & Technology Council (MASTEC)**, an autonomous body under the Department of Science & Technology, Government of Manipur, for organizing the **3-Day State Level Science Congress for Teachers and Researchers** from **March 24–26, 2026** on the theme ***"Innovative Science Education for a Sustainable Future."***

This Congress is a significant step forward in strengthening science education. It offers teachers and researchers a valuable platform to share innovative teaching methods, explore new advancements, and exchange ideas that enhance awareness of diverse approaches to science learning. Most importantly, it encourages collaboration and dialogue among educators, helping to improve the overall quality of science teaching across the state.

The efforts of MASTEC deserve heartfelt appreciation, as this initiative not only honours the dedication of our educators but also reinforces our shared vision of building a sustainable future through science education.

(Ng. Bhogendra Meitei)
Director Education (S)
Govt. of Manipur.

Dr. Kh. Rakesh
Director
Manipur Science and Technology Council
(An autonomous body of the Department of Science and Technology, Govt. of Manipur)

Science and Technology Complex
Takyelpat, Imphal – 795001
E-mail: khrakesh1@rediffmail.com
Mobile: 7005145691

Message

It gives me immense pleasure to present this Abstract Book of the 3-Day State Level Science Congress for Teachers and Researchers 2026 during March 24-26, 2026 under the theme "Innovative Science Education for a Sustainable Future".

Science education plays a pivotal role in shaping the intellectual and innovative capacity of young minds. Teachers, being the torchbearers of knowledge, have the unique responsibility of nurturing curiosity, critical thinking, and scientific temperament among students. This Congress serves as a valuable platform for educators to exchange ideas, share best practices, and showcase innovative approaches in teaching science.

The abstracts included in this volume represent a thoughtful blend of both scholarly literature and original research, reflecting diverse perspectives aligned with the central theme. They highlight innovative emerging ideas, and practical approaches that aim to make science education more relevant, engaging, and future-oriented.

I would like to express my gratitude to the advisory and organizing committees for their careful planning and dedication in the successful conduct of this Congress. I also extend my best wishes for the grand success of the Congress.

Dr. Kh. Rakesh
Director

Dr. Rakhi Khunjamayum
Scientific Officer, MASTEC
Manipur Science and Technology Council
(An autonomous body of the Department of Science and Technology, Govt. of Manipur)

Science and Technology Complex
Takyelpat, Imphal – 795001
E-mail: khrakesh1@rediffmail.com
Mobile: 7005145691

Message

It is a matter of great privilege and satisfaction to present this Abstract Book of the 3-Day State Level Science Congress for Teachers and Researchers 2026 organized by Manipur Science & Technology Council (MASTEC) and supported by the Department of Science and Technology, Government of Manipur during March 24-26, 2026.

The theme, "Innovative Science Education for a Sustainable Future," highlights the pressing need to transform our teaching practices in ways that nurture scientific curiosity while promoting sustainability. In today's dynamic world, educators must continuously explore new methodologies that make learning more meaningful, experiential, and relevant to real-life challenges.

This Abstract Book is a compilation of both scholarly literature and research contributions from dedicated teachers. The diverse range of abstracts reflects innovative ideas, classroom practices, and research insights that align with the vision of sustainable and meaningful science education.

Organizing this Congress has been a collaborative effort, and I express my sincere appreciation to all contributors, participants, and members of the organizing team for their dedication and support. Their collective efforts have made this initiative both possible and impactful.

I am confident that this Congress will serve as a vibrant platform for professional dialogue, knowledge sharing, and the promotion of innovative practices in science education.

May all participants gain a valuable and inspiring experience during this three-day Congress.

Rakhi Kh

Dr. Rakhi Khunjamayum
Organizing Secretary

3-DAY STATE LEVEL SCIENCE CONGRESS FOR TEACHERS AND RESEARCHERS

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Content

3-DAY STATE LEVEL SCIENCE CONGRESS
FOR TEACHERS AND RESEARCHERS

INVITED TALK

Effective Ways of Physics Teaching and Learning

Prof. N. Nimai Singh
Research Institute of Science and Technology (RIST), Manipur

Introduction on Education:

Education is generally considered as driving force of human civilization. We come across many faces of education. Education is considered as the "Third Eye of God Shiva", to be acquired through only education by the person in addition to his two eyes gifted from birth, in order to make a perfect and able human being in the society. According to Mahatama Gandhi, education is the foundation of human character which can impart curiosity and desire to earn new knowledge. According to him, once the right character is imparted, education is completed, and the person will learn by himself without the need of external support. Albert Einstein once remarked, "Education means the training of imagination and critical thinking capability". The best definition of education to me, is the process or linkage of transferring human knowledge and civilization from past generation to present and then to future generation through education, where students and teachers are both active players. Once education ceases to exercise, our future generation will go back to the era of pre-historic caves. It is just like a next stage of a rocket firing. UNESSCO's message for a sustainable development of a Nation is the synergy of three factors - education, research and innovation, known as knowledge triangle.

Quality of a Physics Teacher:

For science education in general and physics education in particular, it is to impart motivation and inspiration for thinking of original ideas, creativity and ingenuity. A teacher of physics education should have the following positive mindsets:

- Conceptual clarity of the topic under study
- Ability to develop the mathematical formulation of the topic, as the mathematics is the language of physics
- Command of English language and rich vocabulary to express effectively the crux of the problem
- Unique style of presentation and demonstration
- Open mind and alternative ways of looking the solution of the problem
- Physical interpretation of the mathematical equation and discussion on the implication
- To impart arts of asking question as a part of education – two-way interactive

education

- To train how to solve unseen numerical problems based on the topic application of the knowledge
- To practice the concentration in rational and deductive logic, to develop automatic reflect action as a kind of sixth sense or intuition in the calculation.
- To practice the sense of a rescue mission or helping hand to students
- To practice conceptual clarity - A three-minutes explanatory speech on a scientific topic and a research topic to inculcate precision of thought, economy of expression

Most important strategy is how to inspire our younger generation. Let us remind of a beautiful poem:

A poor teacher tells,
An average teacher explains,
A good teacher demonstrates,
A great teacher inspires.

Conceptual Development of a Topic:

Physics education is also related to a historical background on the evolution of the concept i.e. conceptual evolution of the topic. We can distinguish between History of science and Science in History. Planck's black body radiation formula, Bohr's atomic model with angular momentum quantization, Dirac's equation with first order differential equation of space and time, to mention a few are examples of science in history having a long history behind the discovery.

We must be able to identify the fact that Physics education starts from certain axioms, hypothesis or postulates. The subject is developed from this starting point. In mechanics, Newton's three laws of motion are the starting postulates based on observations by Galileo and others. From these laws we developed the whole mechanics. In classical mechanic, principle of least action and Lagrangian function is the starting postulate and Newton's laws can be derived from it. Albert Einstein developed his special theory of relativity from two postulates. Similarly, Quantum Mechanics is developed from a set of postulates in analogy with classical mechanics. The underlying point is it works for smaller atomic sizes. Therefor it is futile exercise to derive Newton's laws or Schrodinger equation as they are starting points. The Big bang theory of the birth of the universe, is based on the assumption that there was a big bang at the origin of time and the big bang theory is the consequences after this. The question still remains the theory how the big bang occurred. There are many examples in physics education and our analysis depends on this first postulates. This should be clearly stated while teaching physics.

Debate between Basic and Applied Physics:

There are two approaches of Physics basic and applied. Basic physics is based

on fundamental knowledge which deals with deeper understanding of nature, and it leads to a paradigm shift in scientific revolution. It gives a self-sustaining new knowledge. Applied physics is based on use of physics as a tool to bring a technologically sustainable development of a nation, which can finally boost economy. In the present scenario it is considered that developing and poorer nations are expected to focus only on applied physics that can give direct results to the economy of the nation. For developing and poorer nations to work on pure and basic science, is often viewed as indulgent and wasteful. Therefore, many government fund3ed projects are largely based on applied sciences to boost economy. In other words, education and research in basic science is not encouraged because of its less economic value.

The bias on basic science in the name of less economic value is not a very good concept. In applied science the goal is merely to use research as a tool, but research in basic science is to become a valuable and self-sustaining pursuit in its own right. Research in basic science will generate completely new knowledge which can lead the heart of modern economy e.g, quantum physics. It may not give us an instant result but it will give us a deeper understanding about the world that changes all the time, a paradigm shift in scientific revolution and a lasting change in science of the nation. It offers an opportunity for scientists to stand on their own feet without the need for international supports to assess the scientific questions of their own nation and to contribute to the universal quest for knowledge. China is leading a balance between encouraging basic science and d3emanding technological output to face the futuristic 21st century. In short in the history of science it is practically impossible to find a piece of technology that cannot be traced back to the work of scientists motivated purely by a desire to understand the world. Examples are Electromagnetic theory by James Clerk Maxwell (1865), Quantum mechanic (1954) to quantum computer etc.

Two Aspects for Excellence:

Excellence in Science Education: To bring excellence and sustainability in innovative Science education of a nation, we can broadly point out two factors the first one is the human factor which largely depends on work culture, ethics, responsibility and commitment to the profession. The other factor largely depends on material factor such as infrastructures of educational tools and funding. The first factor is generally taken as first priority while second factor is catalytic supplements. In India pre-independent era showed great potential in science such as C.V. Raman, S. N. Bose, Meghanath Saha, Homi Bhabha to mention a few, as compared to post independent era with full of funding and facilities.

Microbial Solutions for 21st Century Challenges: Superbugs: How to Kill the "Unkillable" Germs?

Debananda Singh Ningthoujam
Département of Biochemistry, Manipur University
E-mail: debananda.ningthoujam@gmail.com/

Introduction

Humankind is beset with multiple 21st century (21C) challenges that pose enormous hurdles to sustainable long-term human economic, energy, social, political and environmental security. These 21st century issues include (but not limited to) the following:

·Global climatic change: rising temperatures, erratic weather patterns, sea-level rise, ocean acidification and coral bleaching, water scarcity etc.

·Emergence of zoonotic diseases and new epidemics and pandemics such as COVID-19.

·Rise of antimicrobial resistance (AMR) and drug-resistant superbugs.

·Increasing incidence of lifestyle diseases (non-communicable diseases) e.g. obesity, diabetes and CVDs.

·Mental health issues esp. in youth e.g. ADHD (due to high screen time).

·Habitat destruction and biodiversity erosion.

·AI and automation disrupting job security.

·Social inequity leading to social disorder.

·Worsening geopolitical conflicts

·Sustainable energy security: fossil fuels to renewable energy resources and fight for rare earth elements.

·Food insecurity: climate change threatens crop yields, need for less inputs of synthetic agrochemicals, and more use of microbial bioinoculants, urgent need for stress-tolerant agriculture; problems of overfishing, soil degradation and water shortage.

·Burgeoning urbanization, overcrowding, housing and sanitation constraints; increasing water, air and soil pollution.

·Media: rapid spread of misinformation & disinformation; social media & public opinion; lack of trust in public institutions.

·Ethical issues: Rise of GMOs, GM crops and synthetic life; singularity and AGI, threat to human intelligence; and possible extinction of humankind.

For the purpose of this talk, let us focus on an overview of the following issues with especial focus on issue no. 5:

1. Westernization of food, gut dysbiosis and NCDs (need for promoting whole food, plant-based nutrition and traditional food systems.
2. Search for microbial bioenergy resources.
3. Development of biostimulants for 21C agriculture.
4. Preservation of unique ecosystems and mitigation of biodiversity loss.
5. Rise of AMR, spread of superbugs and exploration of new antibiotics and drugs.

What is AMR?

Antimicrobial resistance (AMR) refers to the capacity of microbes-bacteria, fungi, viruses-to withstand drugs (antibiotics) designed to kill them. In a way, these microbes are kind of □unkillable germs!□ We may, soon, be entering a post-antibiotic age. (Most currently used antibiotics were discovered during the golden age of antibiotic discovery-1940s to 1970s- and the last antibiotic class was discovered in 1987.)

Very soon, routine procedures such as surgeries, cesarian sections, and organ transplantations may become a lethal event. The medical procedure may be successful but the patient may die from infections by AMR bacteria and fungi.

The rise of AMR has now become a global health challenge.

Why AMR happens?

AMR happens due to:

- Misuse, abuse and overuse of antibiotics.
- Use of antibiotics in livestock, agriculture and aquaculture.
- Incomplete treatment regimen
- Poor hygiene surveillance
- Lack of pharmaceutical development.

Abuse/Misuse denotes use of antibiotics for cold or flu or incomplete course of treatment. Overuse means excessive prescribing of antibiotics. It may also refer to use of antibiotics for preventative use.

1.14 million people died of AMR globally in 2021 (2, 67, 000 in India alone). It is projected that, by 2050, almost 10 million people will die of superbug infections globally every year. This may outstrip the deaths due to cancers of CVDs.

Why AMR is worrisome?

- Infections may become impossible to treat.
- Increased risk of deaths.
- Longer hospital stays and loss of working hours.

What are Superbugs?

Microbes especially bacteria that are resistant to multiple antibiotics are called superbugs. In other words, they are germs that can survive drugs that normally kill them. They have emerged due to the rapid rise of AMR across the globe.

Classes of Superbugs (WHO, 2017; 2024)

- Critical group: ***A. baumannii; Enterobacterales*; and *Mtb***.
- High group: ***S. typhi, Shigella spp.; Enterococcus faecium***; ***P aeruginosa; Salmonella spp.; N. gonorrhea***, and ***S aureus***.
- Medium group: ***Group A Streptococci; Streptococcus pneumoniae; H. influenzae***; and ***Group B Streptococci.***

Many authors pick out the most threatening superbugs and group then within the acronym ***ESKAPE pathogens*** which include:

- *Enterococcus faecium (vancomycin-resistant; causes UTI and wound infections)*
- *Staphylococcus aureus (causes bloodstream infections)*
- *Klebsiella pneumoniae (Carbapenem-resistant; causes wound infections)*
- *Acinetobacter baumannii (common in ICUs)*
- *Pseudomonas aeruginosa (bloodstream infections)*
- *Enterobacter spp. (nosocomial UTI and respiratory infections).*

Drugs for Superbugs

Many approaches are needed. Most low-hanging fruits have been picked already. So, we need to look beyond the usual soil environments. Most search strategies use the following approaches so far:

1. Deep sea: Abyssomycins and Salinosporamide A
2. Cold desert (Atacama Desert, Chile): Chaxamycins and chaxapeptins
3. iCHIP technology: Teixobactin (2015) and Clovibactin (2023)
4. Metagenomics: Malacidin
5. AI: Halicin and Abaucin
6. Symbiotic bacteria: Darobactin, Dentigerumycin and Formicamycins
7. Repurposing: Auranofin
8. Human microbiome: Lugdunin
9. Combination therapy
10. Genome mining etc.

Coda

Superbugs represent a major health challenge in the 21st century. Unless we take urgent steps, we will face the scenario of antibiotic apocalypse. Routine procedures, hip replacement surgeries and organ transplants would become lethal procedures. Superbug infections would be the top killer by 2050.

We need to follow:

- ***Responsible antibiotic use***
- ***Improved diagnostics***

- ***Global surveillance and cooperation.***

In addition, we need to search far and wide for novel antibiotics in/by:

- ***Extreme ecosystems such as deep sea or deserts***
- ***Underexplored habitats such as Manipur***
- ***Ant/insect associated bacteria***
- ***Endophytic bacteria and fungi (sleeping inside ethnomedicinal plants***
- ***AI***
- ***Genome mining***
- ***Repurposing of old drugs/antibiotics etc.***

We need to nurture research on microbe-derived antibiotics against superbugs in labs across the universities and colleges in Manipur. In addition, investigations may be taken up to develop biostimulants/bioinoculants for stress tolerant crops (rice and other major crops) for growth under drought/heat stress and microbe-derived biofuels. Research projects may also be conducted in the field of probiotics for boosting gut health by using our traditional fermented foods (e.g. soibum) as source of probiotic bacteria and fungi.

Governmental science agencies in Manipur such as MASTEC, DST Manipur, and Dept. of Environment and Climate Change, Manipur may initiate schemes for supporting minor/major research projects in colleges and universities across Manipur state.

Online Resources for Teaching, Learning and Research in Biological Sciences

S. Sureshkumar Singh
Department of Botany, School of Life Sciences, Manipur University
Email: suresh@manipuruniv.ac.in

There are large numbers of online resources for teaching, learning and research activities in different areas of biological sciences including biotechnology and bioinformatics. Use of these resources will help in enhancing understanding of the theoretical concepts on different topics of in biological sciences in the classroom teaching programs for schools, colleges and universities. The online resources can be broadly grouped into four categories, i) Online Teaching & Learning Sites, ii) Free Online Books, iii) Open Access and Free Online Journals, and iv) Online Biological Databases. Most of these resources are hosted by government and private institutions and organizations in India and other countries. These web resources provide ebooks, video lectures, animated demonstrations, virtual laboratory experiments, and simulation models. A few examples of Online Teaching and Learning sites are National Digital Library of India (NDLI), Online Labs (OLABS), National Programme on Technology Enhanced Learning (NPTL), DNA Interactive, DNA from Beginning, LabXchange, Nature Education (SCITABLE), Online Lectures & Videos. Among Online resources for Books, Bookshelf of National Center for Biotechnology Information (NCBI), Internet Archive and Biodiversity Heritage Library (BHL) are few examples which provide free access to several text books and reference books in the form of ebooks related to biological sciences and other disciplines. For advanced level studies and research, there are several web resources particularly e-journals which provide free full text access to research articles. Some of these resources include PubMed Central® (PMC, NCBI) which archives articles published in more than 4000 journals from different publishers, Biomedcentral (BMC, Springer-Nature) publishing above 300 open access research journals, Other open access journals are hosted at J-STAGE (JST Japan) with more than 4000 journals, MDPI MDPI (Switzerland) with more than 500 open access journals, etc. The Directory of Open Access Journals (DOAJ) lists about 14000 journals in all disciplines published from more than 140 countries. The last category, Online Biological Databases are websites hosting various databases on diversity, biochemicals, proteins, biochemical pathways, diseases, genetic sequences, genome, etc. of living organisms. These are public databases and can be used by every user across the world through internet. Effective use of these online resources will improve practical knowledge of biological students and will help in skill development for career enhancement of teachers.

A talk on Careers in Mathematics

Dr Khwairakpam Herachandra Singh
Deparment of Mathematics
Manipur University
heramath@manipuruniv.ac.in
+91 9436346673

The presentation will begin with an overview of the history of mathematics and highlight some of the top institutions in India where mathematics is studied. It will feature notable mathematicians from India as well as local mathematicians affiliated with these institutions. While many people view mathematics as a tedious subject, it is also often regarded as the foundation of science. The talk will also outline the structure of the Mathematics Olympiad Examination in India and explain its selection process. Additionally, some mathematical concepts and terminology will be discussed.

Artificial Intelligence as a Teaching Assistant: Transforming Science Education

M. Shubhakanta Singh,
Department of Physics, Manipur University

In today's rapidly evolving educational landscape, Artificial Intelligence (AI) is emerging as a powerful tool that can support and enhance the work of teachers, especially in science education at the school and higher secondary levels. Rather than replacing teachers, AI serves as a reliable teaching assistant helping educators plan lessons, explain complex concepts, and engage students more effectively.

One of the most significant advantages of AI is its ability to simplify difficult scientific ideas. Topics such as electrostatics, chemical reactions, or calculus often pose challenges for students. AI tools can present these concepts in multiple ways through simple language, analogies, step-by-step explanations, and even visual representations making them more accessible to diverse learners, particularly those who struggle in traditional classroom settings.

AI also plays a crucial role in saving teachers time. Preparing lesson plans, designing question papers, and creating teaching materials can be time-consuming tasks. With the help of AI tools like ChatGPT and Canva, teachers can quickly generate structured lesson plans, interactive presentations, worksheets, and assessments. This allows them to focus more on meaningful classroom interaction and student support.

Another important benefit of AI is personalized learning. Every classroom consists of students with varying levels of understanding. AI can adapt explanations based on the learner's level, offering additional practice, simpler explanations, or advanced challenges as needed. Weak students, in particular, benefit from AI's patience it can repeat explanations multiple times without judgment, creating a safe and supportive learning environment.

Moreover, AI enhances student engagement by making learning interactive. Teachers can use AI to generate quizzes, real-life examples, and visual aids that stimulate curiosity and participation. In science education, where visualization and application are key, such tools can significantly improve conceptual clarity and interest.

However, it is important to acknowledge that AI is not without limitations. It may sometimes provide incorrect or oversimplified information, and therefore, the teacher's role remains central. Educators must guide, verify, and contextualize AI-generated content to ensure accuracy and relevance.

In conclusion, Artificial Intelligence has the potential to transform science education by acting as an intelligent assistant to teachers. By embracing AI thoughtfully and responsibly, educators can create more engaging, inclusive, and effective learning experiences for students. The future of education lies not in choosing between teachers and technology, but in combining the strengths of both.

3-DAY STATE LEVEL SCIENCE CONGRESS
FOR TEACHERS AND RESEARCHERS

ABSTRACT

TSC26001

INNOVATIVE SCIENCE EDUCATION FOR A SUSTAINABLE FUTUREIN BISHNUPUR DISTRICT, MANIPUR

Khangjrakpam Vijayalakshmi
Primary Teacher Khoijuman Government Junior High School
Email: khangvijayalakshmi@gmail.com

ABSTRACT

Innovative science education plays a crucial role in preparing young learners to address environmental, social, and economic challenges in a sustainable manner. In Bishnupur District of Manipur, integrating locally relevant scientific knowledge with experiential learning approaches can significantly enhance students understanding of sustainability concepts. This study highlights the importance of activity-based learning, inquiry-based pedagogy, and the use of indigenous knowledge systems in science classrooms at the upper primary level. It emphasizes the role of teachers in fostering environmental awareness, critical thinking, and problem-solving skills among students through hands-on experiments, community-based projects, and eco-friendly practices such as school gardening, waste management, and water conservation initiatives. The paper also examines challenges faced by rural schools, including limited infrastructure, inadequate laboratory facilities, and insufficient teacher training opportunities, while suggesting practical solutions such as low-cost teaching aids, digital learning resources, and collaboration with local communities. By promoting innovative teaching strategies aligned with sustainable development goals, science education can empower students to become responsible citizens who contribute positively to environmental conservation and community well-being. The study concludes that strengthening innovative science education at the grassroots level is essential for achieving a sustainable future in the region. Keywords: Innovative education, Science learning, Sustainable development, Experiential learning, Environmental awareness, Rural education, Manipur.

TSC26002

□INTEGRATING STEM EDUCATION FOR SUSTAINABLE DEVELOPMENT□ (FUTURE)

Oinam Uchao
Science Teacher, Heirangoithong High School
Email: oinamuchao1969@gmail.com

ABSTRACT

Sustainable development is one of the most pressing global priorities of the 21st Century, requiring innovative solutions grounded in Science, Technology, Engineering and Mathematics (STEM). Integrating STEM education provides a transformative approach to equip learners with the knowledge, skills and critical thinking abilities necessary to address complex environmental, social and economic challenges. By connecting interdisciplinary concepts with real-world sustainability issues such as climate change, renewable energy, waste management, and resource conservation □ STEM education fosters problem □ solving, creativity, collaboration and technological innovation.

This seminar explores how integrated STEM learning frameworks align with the goals of the United Nations□Sustainable Development Goals, emphasizing quality education, climate action, clean energy and sustainable communities. It highlights project-based learning, inquiry driven-approaches, digital tools and community engagement as key strategies for effective implementation. Furthermore the discussion addresses the role of educators, policy makers and institutions in creating inclusive and equitable STEM opportunities that empower future generations.

By embedding sustainability principles within STEM curricula, education systems can nurture environmentally responsible citizens and innovative leaders capable of designing resilient solutions for a rapidly changing world. Integrating STEM education is not merely an academic reform but a strategic pathway toward building a sustainable and prosperous future for all.

TSC26003

INNOVATIVE PEDAGOGICAL APPROACHES IN SCIENCE TEACHING FOR SUSTAINABLE DEVELOPMENT

Athokpam Ranjita Devi
Assistant Science Teacher, Khangabok Hr. Secondary School
Email: ranjitamekola@gmail.com

ABSTRACT

The transformation of science education in India is strongly guided by the National Education Policy (NEP) 2020 through the National Curriculum Framework 2023, which emphasizes competency-based, experiential and multidisciplinary learning. At the state level, the State Curriculum Framework Manipur contextualizes these national goals to address local needs, culture and environmental priorities. In alignment with these frameworks, innovative science teaching has become essential for promoting sustainable development and scientific literacy among students.

Traditional lecture-based methods often limit inquiry, creativity and application of knowledge. NCF 2023 advocates learner centered pedagogy, integration of indigenous knowledge systems, environmental awareness and real-life problem-solving approaches. Similarly, the SCF Manipur highlights contextual learning by incorporating local ecological concerns such as biodiversity conservation, water resource management and sustainable agriculture. Therefore, innovative pedagogical approaches such as inquiry based learning, project-based activities, experiential fieldwork, ICT integration and community linked science projects are necessary to achieve curriculum goals.

This paper highlights different science teaching methods where students actively engage with joyful learning, local environmental issues, conduct field investigations and apply scientific concepts to real world challenges. Such practices not only enhance conceptual understanding but also develop critical thinking, collaboration and responsible citizenship. By aligning classroom instruction with the vision of NCF and SCF, science teachers can foster sustainable values, promote environmental stewardship and prepare learners for future challenges. Innovative science education thus becomes a powerful tool for building a scientifically informed and sustainability oriented society in the local context.

Keywords: Innovative Pedagogy, Competency, Curriculum Framework, Curriculum Goals, Contextualization.

TSC26004

ZERO-COST NATURAL PH INDICATOR FROM BLACK RICE (CHAKHAO) : A GREEN GATEWAY TO HANDS-ON ACID-BASE LEARNING

Shoibam Anilkumar Singh
Charangpat High School
Email: shoibamcha@gmail.com

ABSTRACT

Traditional synthetic pH indicators, such as phenolphthalein and universal indicator solutions, pose significant challenges in school science education, including high costs, chemical toxicity, safety hazards, and environmental concerns. This project presents an innovative, zero-cost, and fully eco-friendly alternative: a natural pH indicator extracted from black rice (locally known as *chakhao* in Manipur), which is rich in anthocyanin. These water-soluble pigments exhibit striking, reversible colour transitions across the pH spectrum vivid red to pink in acidic conditions, purple near neutral pH, and progressive shifts to blue, green, and eventually yellow in increasingly basic environments making the indicator highly visual and pedagogically effective.

The extraction process is deliberately simple, scalable, requiring only kitchen utensils (water, heat source, and strainer) and completed within 40 minutes, rendering it ideal for the classroom implementation even in resource-limited settings. Students use the resulting extract to test readily available household substances (e.g., lemon juice, vinegar, baking soda, soap, and detergents), enabling safe, engaging, and multisensory experiments that stimulate curiosity and reinforce conceptual understanding of acids, bases, and neutralization. This sustainable approach directly addresses educational inequities by eliminating procurement barriers for underfunded schools, particularly in rural and remote areas such as Manipur and similar regions across developing countries. By replacing synthetic chemicals with locally abundant, biodegradable material, the method reduces both classroom chemical exposure risks and environmental pollution from laboratory waste disposal. Preliminary classroom trials demonstrate. Improved student engagement, enhanced procedural and observational skills, and better data interpretation abilities. The *chakhao*-based indicator thus serves as a powerful tool for experiential, inquiry-based learning while promoting environmental responsibility, scientific equity, and cultural Relevance in science education. This low-barrier innovation has broad potential. For global adoption in primary and secondary curricula, empowering learners through accessible, green hands-on science.

TSC26005

SCIENCE POPULARISATION FOR SUSTAINABLE DEVELOPMENT

Irom Sushilkanta Singh
Science Communicator Manipur Science Communicators Association (MASCA)
(A Society working on Science Popularisation)
Khagempalli Panthak, Imphal West, Manipur- 795001
e-mail: masca.science.in@gmail.com

ABSTRACT

Science popularization is to bring Science close to the People or General Public, and to disseminate scientific knowledge and also foster a scientific way of thinking among the commoners. In particular, science popularization refers to public understanding of the basics of science and public communication of scientific research projects, which has a direct link to their life and living. Hence, Science popularization is a powerful tool and a strategic measure to build a modern society, not only disseminating all the main, useful knowledge and skills, but spreading a general approach of scientific living, without prejudice and to adopt a common culture of science. Every topic or title can be the object of science popularization; it just depends on the communication skills of who is in charge of the dissemination. In simple words, we can always say that Science Popularization is the process, which makes the Scientific Language simpler & easier for the common people for whom understanding of that language is otherwise generally difficult. Hence, a science populariser is also known as a Science Communicator. Science Popularization is the social commitment, mainly concerning health & environmental areas and also many other areas related to human day today life only. Science populariser is the one who bridges the gap between the Science & the Public. Science Popularization is also the tool to bridge the growing gap between the Society & the larger world of science.

Hence it is extremely important to use Science to achieve Sustainable Development at present and it is at the same time equally important to take a series of initiatives to popularise Science, which ultimately benefit us and our Society as a whole.

TSC26006

FROM CLASSROOM TO LIVING LABORATORY: ENGAGING STUDENTS IN MICROCLIMATE RESEARCH FOR A SUSTAINABLE FUTURE

Tong Tong Serto
Lecturer (Botany), Ibotonsana Girls□Hr.Sec. School
Email: sertotong9@gmail.com

ABSTRACT

Contemporary science education increasingly emphasizes innovative pedagogical approaches that connect classroom learning with real-world environmental challenges. This study presents an experiential learning initiative in which the school campus and its surrounding environment are transformed into a living laboratory for investigating *Microclimate* variation. The Project actively engaged students in observing and analyzing temperature and humidity differences across shaded and exposed zones within and around the school campus.

Students conducted systematic temperature and humidity observations using simple digital thermometers across multiple micro- environments including vegetated shaded areas, open playground, building corridor, and nearby roadside zones. Through these participatory approaches, learners explored how environmental factors such as solar exposure, vegetation cover, surfaces characteristics, and human activities influence localized thermal conditions.

The investigation revealed measurable temperature differences ranging from 1–4°C between shaded and exposed locations, even across short spatial distances. Beyond generating environmental data, the activity encouraged students to formulate hypotheses, analyze observations, and interpret results through evidence-based reasoning, thereby strengthening scientific inquiry, environmental literacy, and critical thinking skills.

The study demonstrates how low-cost, field-based environmental investigations can enhance student engagement while promoting sustainability awareness. Such innovative educational practices reflect the vision of the National Education Policy 2020 and contribute to global sustainability priorities articulated in the United Nations Sustainable Development Goals.

Keywords: Microclimate, Temperature Variation, Experiential Learning, Living Laboratory, Sustainability Education

TSC26007

SCIENCE EDUCATION IN HIGH SCHOOL IN MANIPUR

Oinam Ibochou Singh
St. George High School, Wangkhei
Email: ibochouoi@gnmail.com

As we can be defined that Science is a collection of methods and resulting theories aimed at creating thorough explanation and understanding of natural phenomena. Generally, science is one of the tough and difficult subject due to having different terminology, word meanings as well as memory. From the olden days, people can use the different scientific principles in their daily lives such as cutting of vegetables by sharp knives, drawing of water from the wells, lifting heavy objects from the ground at different heights, nailing on the walls or woods by a sharp end etc. People could not think about the scientific approach. Students can also learn and study science in high school by traditional methods of teaching i.e., without proper teaching aids. They think about the passing this subject only but they didn't understand thoroughly. This makes them to ignore this subject in higher studies. Instead of the traditional methods of teaching a science, we need to change this method to the modern system of teaching methods like demonstration method, hands on based activity, project-based learning, experimental learning, etc. Usually in Manipur, science is one of the subjects who does not takes as a favorite subject. 30% of the students are failed in this subject in the public examination every year. Due to this reason, students left this subject in the higher studies. Most of the schools depends on old method of teaching i.e., lecture methods. But some of the schools had recently implemented modern system of education according NEP 2020 in which it enhances and promote to the mind of young students who want to become the pillars of the nation. For this, I can conclude that Science education must be fruitful when we change the traditional methods to modern technology for better achievement and enthusiastic of the future.

Keywords: Natural phenomena, terminology, scientific principles, traditional methods, modern system of teaching, hands on, NEP- 2020.

TSC26008

MANIPUR EXPERIENTIAL SCIENCE EDUCATION MODEL (MESEM)

Mohamed Azid Moijingmayum
HOD of science departments of Manipur creative school, Dewlahland, Imphal.
Email: azidlove90@gmail.com

ABSTRACT

Science education plays a crucial role in developing scientific temper, creativity, and problem-solving skills among students. However, many classrooms still depend heavily on theoretical instruction and memorization, limiting students ability to connect scientific concepts with real-life experiences. Manipur, with its rich biodiversity, diverse ecosystems, and strong indigenous knowledge systems, offers valuable opportunities to transform science education into a more experiential and context-based learning process. This paper explores innovative teaching approaches that integrate local environmental resources and traditional knowledge into science education. Methods such as field observation, project-based learning, and the use of local ecosystems as living laboratories can enhance students understanding of scientific concepts. The study highlights how integrating environmental contexts and indigenous practices can promote sustainability, curiosity, and practical learning among students. The paper also suggests the inclusion of experiential learning strategies in school curricula and teacher training programs to make science education more engaging and relevant.

TSC26009

REIMAGINING SCIENCE EDUCATION FOR A GREENER FUTURE

Hanjabam Sangeeta Devi
Taobungkhok Upper Primary School, Imphal west
Email: sangeeta.gurumayum@gmail.com

ABSTRACT

Science education plays a vital role in preparing responsible citizens capable of addressing the environmental challenges of the 21st century. With growing concerns such as climate change, biodiversity loss and resource depletion, it is essential to rethink how science is taught in schools. Reimagining science education for a greener future requires moving beyond traditional textbook based instruction and adopting innovative, experiential and sustainability-oriented approaches that empower learners to become active problem solvers.

Innovative science education integrates interdisciplinary learning, real world problem solving and environmental awareness into classroom practices. By linking scientific concepts with local ecological issues, students gain a deeper understanding of sustainability and their role in protecting the planet. Approaches such as enquiry-based learning, project-based activities, citizen science initiatives and the integration of digital tools encourage students to investigate environmental problems creatively and collaboratively. Hands-on experiences such as developing school gardens, conducting waste management and water conservation projects and exploring renewable energy solutions allow learners to see science as a practical tool for sustainable living.

In addition, incorporating indigenous knowledge and local environmental practices enriches scientific understanding and promotes culturally relevant solutions to sustainability challenges. Teachers play a crucial role as facilitators who nurtures curiosity, critical thinking and environmental responsibility among students. Continuous professional development and access to innovative teaching resources are therefore essential to support educators in implementing these transformative approaches.

Reimagining science education also aligns with global sustainability goals by fostering environmentally literate citizens capable of making informed decisions. By engaging students in community-based environmental initiatives and solutions-oriented learning, science education can inspire the next generation to actively contribute to building a greener and more sustainable future.

TSC26010

THE SYMBO CARD

Ningombam Chandraleikha Devi
Lamlong Higher Secondary School
Email: chandraleikhasoibam@gmail.com

ABSTRACT

The basic learning of chemistry is to memorize chemical symbols and formulas. Memorization of fundamental chemical nomenclature and valencies is very crucial for subsequent studies in chemistry and related sciences. This project explores the design and utility of hand-crafted visual aids in chemistry education, specifically for memorizing chemical symbols and polyatomic ions in a play-way manner. Using color-coded flash cards as a medium in the form of playing cards, where students have to form compounds, give the names and try to combine or pair the cards seeing the charges and valencies of the elements or polyatomic ions. The study examines how tactile vibrant representative of elements such as Barium Ba^{2+}, Mercury Hg^{2+}, and Magnesium Mg^{2+}, etc. alongside polyatomic ions like Chromate and Borate facilitate better retention compared to traditional rote memorization from a textbook. The image displays an educational activity involving flash cards designed to facilitate the recognition and understanding of chemical elements and polyatomic ions.

To enhance student□s proficiency in identifying the chemical symbols, names and associated charges of common elements and ions, is the main objective. Utilizing a set of handmade flash cards, students are engaged in visual recognition drills. The cards featuring information such as Barium, Ba^{2+}, etc. are distributed among the students and it is played like the playing cards giving them chance to take up cards turn-wise and they try to form compounds by combining elements or polyatomic ions accordingly to their valences and charges. The earlier the formation of the compound and the ability to give them nomenclature declare the winner.

This tactile and visual learning method aids in the memorization of fundamental chemical nomenclature and valencies, which are crucial for subsequent studies in Chemistry and related science.

The use of custom learning aids like the flash cards in the play form is an effective strategy for re-inforcing core chemical knowledge in a hands-on manner.

Key words: Nomenclature, Hand crafted, Visual aids.

TSC26011

SCIENCE EDUCATION IN KAMJONG DISTRICT OF MANIPUR; ISSUES AND CHALLENGES

Takhellambam Robindro Singh
Lecturer in Physics, Phungyar Hr. Sec. School,
Kamjong District
Email: robindro1606@gmail.com

ABSTRACT

Science education in schools of hill districts of Manipur faces many issues and challenges like Infrastructure Deficits, Shortage of Teacher & Training, Language Barrier, Socio-economic & Geographic Hurdles, Conflict and Instability, Low Student Enrolment in Science, Weak Administration & Monitoring, Poor Laboratory Facilities etc. Whereas, the present condition of roads and telecommunication services in remote areas of the hill isolated the people and unable to draw the government's attention. To overcome, the science education challenges in Manipur's hill districts, it is essential to urgently address the chronic shortage of qualified teachers, upgrade school infrastructure with laboratory equipment and provide consistent, technology-enabled learning resources. Prioritizing teacher training and frequent science awareness programs to the school children.

TSC26012

REVERSING THE STEM "LEAKY PIPELINE": USING MANIPUR'S BIODIVERSITY AND INSTITUTIONAL INTERNSHIPS TO ENHANCE SCIENCE RETENTION FOR CLASSES IX–XII

Dr. Sanasam Satyabhama Devi
Science Graduate Teacher (SGT), Wangkhei High School
Email: satyabhamasanasam77@gmail.com

ABSTRACT

Science education is the key to national growth, and in India, there is a critical "leaky pipeline" problem wherein only 40 to 50 percent of students in science education pursue pure science, engineering, or medicine in higher education. Around 50 to 60 percent of students are forced to pursue alternative courses of study such as arts, management, Law, or commerce, and this is largely due to a lack of "experiential learning." To address this issue, this research proposes a paradigm-shifting idea wherein Manipur's "natural landscape" is transformed into a "school-level practical laboratory." In this way, educators can develop the critical thinking and problem-solving skills that are important to active citizenry.

A 15-day research internship in higher education institutes, colleges, and universities is proposed in this framework, inspired by international "Summer and Winter Schools." This is a "professional opportunity" wherein educators can update their skills and make sure "socio-level classrooms" act as "hatching grounds" for higher education. For students in Class IX-XII, this is an important bridge between education and regional growth, wherein students are exposed to endemic flora and fauna in Manipur's biodiversity.

In addition to this, this model offers a strategic advantage to the host institutions as an increase in scores of both NAAC and NIRF, owing to the research extension and innovative methodologies of teaching. By enabling students to go beyond rote learning, this initiative equips them to face the challenges of the world, thus ensuring the relevance of science education.

Keywords: STEM Retention, Living Laboratory, Research Internships (IX-XII), NAAC Accreditation, Manipur Biodiversity, Science Popularization, Experiential Education, Sustainable Innovation.

TSC26013

3H MODEL FOR TRANSFORMATIVE AND INNOVATIVE SCIENCE EDUCATION

Hijam Bidyalaxmi Chanu
Lamdeng High School
Email: bidyalaxmichanu6@gmail.com

ABSTRACT

The rapid acceleration of technological advancements in 21st century and urgent need for environmental sustainability necessitate a paradigm shift in science education moving beyond conventional knowledge transmission. This paper explores the 3H model-Head, Heart and Hands as a holistic framework for fostering transformative and innovative science learning. This seminar paper analyzes how integrating these three domains can transform science classrooms from passive environments into proactive hubs of inquiry and innovation. Scientific knowledge lays the foundation for a sustainable world. A good science education will excite the imagination and inspire, develop valuable skills for life and work and enable to make informed choices. Science learners engage in a process of knowledge, integrate where they make sense of diverse information including their own experiences and contribute to a technologically advancing world. This seminar paper also outlines the critical role of innovative science education for a sustainable future moving beyond traditional road learning to prepare the learners for complex global challenges. Key discussion includes the implementation of 3H in science curriculum design, its role in promoting sustainability and 21st century skills and the role of a teacher in successful implementation.

TSC26014

LEVERAGING DIGITAL MODELLING TOOLS TO BRIDGE SCIENTIFIC THEORY WITH REAL-WORLD SUSTAINABILITY PRACTICES IN HIGH SCHOOL EDUCATION

Dr. Mayengbam Nganthoi Devi
Science Graduate Teacher, Lilong Higher Secondary School, Imphal West-795130
Email: ithoi.mayengbam@gmail.com

ABSTRACT

Besides promoting students, a holistic understanding of how different dimensions of global sustainability issues are interconnected, biology education at the school level can play a significant role in developing environmentally conscious and socially responsible individuals who are capable of effectively addressing global sustainability challenges. This article investigates innovative teaching techniques alongside traditional methods to enhance responsive teaching in classroom, cultivate system-thinking, deeper understanding of biological concepts and raise awareness of sustainability challenges. This article also highlights how the integration of digital modelling tools viz., computational models, computer graphics and animations, offer a transformative approach to biology education in high schools, fostering engagement, conceptual understanding, promote critical thinking and data analysis. Computational modelling, involving the use of computer-based simulations and mathematical models to represent and analyse complex scientific phenomena has emerged as an important tool to enhance science education and supporting the achievement of the Sustainable Development Goals (SDGs) adopted by the United Nations. It allows students to simulate complex systems, analyse scientific phenomena providing interactive experiences that encourage experimentation, hypothesis testing and develop problem-solving skills. In the context of sustainability education, it enables learners understand environmental processes, ecosystem dynamics and resource management. Complementary visualisations through computer graphics and animations make abstract concepts tangible, improving comprehension in different areas of science. Moreover, these tools offer a more practical and efficient alternative to field-based learning and physical models, as they are cost-effective, time-saving, schedule-friendly and more suitable for classroom use while also being environmentally sustainable. This study suggests that integrating innovative pedagogical tools and sustainability

education grounded in local contexts within interactive learning environments can strengthen high school students scientific knowledge and system thinking. Such approaches equip students to address real-world challenges, increase their motivation to learn and foster a holistic and inclusive educational environment that contributes to a sustainable future.

TSC26015

BIOMIMICRY: SOLUTIONS FROM NATURE FOR FUTURE

Moirangthem Gobin Singh
Department of Biology
Little Master English Higher Secondary School
Shamurou, Imphal West
Email: gobinskew789@rediffmail.com

ABSTRACT

Biomimicry is the field of learning from the nature and emulating natural forms and processes to create a more sustainable design. Biomimicry is the imitating of nature designs, shapes and structure in man-made design and technology. It involves understanding how organisms developed the solutions over the year of natural selection. Biomimicry opens the door to innovation in the field of technology, designs, architects, medicine, education, energy and others. It provides solutions in harmony with nature by integrating its balance into man-made system. This paper examines the history, meaning, principles, applications, prospects and its role in sustainable future. This study also focuses on recognizing examples of biomimicry, its current uses and future potential. This paper aims to contribute to the exploration of innovative ideas and solutions to be used in future design and engineering prospects inspired by nature.

Keywords: Biomimicry, nature, sustainable, technology, medicine, education, innovation, exploration.

TSC26016

"INNOVATIVE SCIENCE EDUCATION FOR A SUSTAINABLE FUTURE"

Yengkhom Sunanda
Asstt. Teacher,
Ratankumar Memorial School, Kwakeithel Heinoukhongnembi, Imphal West
Email: sonundaayengkhom@gmail.com

ABSTRACT

Innovative Science Education has been deemed crucial in equipping learners with skills needed to address complex challenges like climate change, resource depletion, social, economic and technological issues which are compounded generally by misinformation and lack of scientific literacy. This serves as the antidote and critical driver that aligns with 21st century's educational demands for a sustainable future ahead of us. While acknowledging and bridging the substantial gap between students' awareness of conceptual understanding and their ability to engage with real world applications, this study highlights the need for pedagogical integration of technologies which are inquiry -based learning and community engagement like engaging the students in science festivals to meet the expectations. Initiatives like STEM education in school curricula with extensive integration of Artificial Intelligence Knowledge, Project- Based Learning (PjBL) and PhET simulations to support science learning from high school will strengthen responsible practices of Education for Sustainable Development in alignment with UNESCO's SDG 4. In this study, we leverage on Indian Science, Technology and Innovation (STI) that draws on existing statistics and newly developed database, indicators and analysis to map the key trends and structural issues which compare the capabilities of countries in this important domain to support responsible decision-making and prepare future innovators and researchers to address pressing sustainability challenges. We also aim to bring forth the importance and adoption of Culturally Responsive Teaching (CRT) method of teaching that can have a significant impact on development of STEM education in India as well. This study finds it most fascinating in encouraging collaboration and deliberation between educators and researchers to develop effective electronic module and gamification of concepts through E-Comics or other learning media implementation strategies in science to facilitate the dynamics of contemporary digital learning. In conclusion, this aims to bring an impact in pedagogical shift from

traditional rote learning of understanding complex science concepts to more tangible, exploratory, analytical and interpretive scholarly approaches improving students Higher Order Thinking Skills (HOTS) to relate experiences in social and professional contexts.

TSC26017

COMPARATIVE PIGMENT PROFILING OF SELECTED WILD EDIBLE PLANTS USING LOW COST PAPER CHROMATOGRAPHY: IMPLICATIONS FOR SUSTAINABLE SCIENCE EDUCATION

Sangita Thiyam
Faculty of Botany, Department of Biological Sciences,
Tamphasana Girls Higher Secondary School, Old Lambulane, Imphal
Email: sangitathiyam@gmail.com

ABSTRACT

Wild edible plants play a crucial role in traditional diets, nutritional security while also representing important components of local biodiversity. However, their pigment composition is rarely explored through experimental approaches in school level science education. This study investigates the pigment profiles of selected wild edible plants using paper chromatography as an accessible and low cost laboratory technique. Fresh leaves of *Centella asiatica, Plantago erosa, Leucas aspera, Cressocephalum crepidioides* and *Amaranthus viridis* were collected from open fields and subjected to pigment extraction. Leaf samples were finely crushed using mortar and pestle, and the pigments were extracted using acetone. The extract was loaded on chromatography paper, and the separation was carried out using solvent mixture of petroleum ether and acetone in the ratio 9:1. The experiment was conducted in the biology laboratory of Tamphasana Girls Higher Secondary School. Distinct pigment bands corresponding to chlorophyll a, chlorophyll b, xanthophyll and carotenoids were observed and analyzed based on their *Rf* values. Environmental parameters such as temperature (degree Celsius), light intensity (lux) was also recorded to provide ecological context to studied plants. The study demonstrates that low cost chromatographic experiments using locally available wild edible plants can serve as effective tools for practical science education. Integrating such accessible experimental methods can promote experiential learning, foster scientific temper among students,

and increase awareness about the ecological importance and conservation of wild edible plants.

Keywords: Wild edible plants; Paper chromatography; Plant pigments; *Rf* value, Sustainable science education

TSC26018

LITERATURE AND THE CULTIVATION OF SCIENTIFIC IMAGINATION IN YOUNG LEARNERS: AN INTERDISCIPLINARY APPROACH TO SCIENCE EDUCATION

Jereeta Khoisnam
Lecturer/Independent Researcher, Temple of Learning, Canchipur
Email:

ABSTRACT

Science education aims not only to impart knowledge of scientific facts but; it also demands imagination, curiosity, and the ability to question the world around them. Literature, which often presents vivid portrayals of nature, human interaction with the environment, and reflections on the mysteries of the natural can serve as a powerful medium for nurturing these qualities. Such representations can stimulate curiosity and encourage learners to observe their surroundings with greater attentiveness. Through an interdisciplinary approach, this paper explores how literature can foster scientific imagination in young learners through language and science education.

Literature often explores themes such as nature, environmental change, discovery, and human interaction with nature. Through storytelling and descriptive language, literature encourages learners to observe their surroundings carefully and to reflect on natural phenomena. Engaging students in such a manner can spark curiosity and inspire them to ask questions about the environment, how natural systems function, and how human actions affect the environment.

The study highlights how selected literary texts that portray nature and environmental awareness can complement classroom science learning. By integrating literature into teaching practices, educators can create interdisciplinary learning experiences where imagination and scientific inquiry work together. Students are not

only exposed to scientific ideas but are also encouraged to think creatively and critically about them.

In contemporary educational contexts, where sustainability and environmental responsibility are key concerns, literature can aid in the development of scientifically literate and socially responsible learners. The paper argues that incorporating literary narratives into science-related discussions can help foster curiosity, deepen students engagement with scientific ideas, and foster a more holistic understanding of the natural world. Such interdisciplinary approaches offer promising possibilities for strengthening science education and nurturing the scientific imagination of young learners.

Keywords: Scientific Imagination; Interdisciplinary Education; Literature and Science; Science Education; Young Learners; Environmental Awareness.

TSC26019

POTTERY MAKING AND SCIENTIFIC CONCEPTS

Longjam Bhushankamal Singh
SGT, Sekmai Khumbi High School (Aided)
Email: *bhushanangom@gmail.com*

ABSTRACT

Science learning becomes more meaningful when it relates to real-life experiences and local practices. One effective way is by integrating traditional knowledge into science education. Pottery making provides a practical context through which several scientific concepts can be understood and applied. The present study attempts to explore the various processes of pottery making and relevant scientific concepts associated with each step of the process and examines how it can be used as an innovative method for teaching science. The study is based on qualitative research involving participant observation of pottery artisans of Nongpok Sekmai, Thoubal District as the primary source of data, along with secondary data collected from books, journals, research articles, and relevant online sources. The study finds that the process of pottery making involves different stages namely the selection and preparation of clay, shaping it, drying, and firing it at high temperature. Each of these stages reflects important scientific concepts related to physics, chemistry, and environmental science. Through pottery making, learners can observe concepts such as soil composition, plasticity, and porosity of clay, transformation of the shapes

and sizes by applying forces, sun-drying and heating effects, and the transformation of clay into hard ceramic material. In addition, pottery products are ecofriendly and alternatives to plastic and other synthetic materials thereby promotes sustainable practices. Learning science through such hands-on activities encourages curiosity, observation, and experiential learning among students. It also helps to bridge the gap between theoretical knowledge of science and practical application. By incorporating pottery into science education, teachers can make learning more engaging and joyful while also fostering environmental awareness and appreciation for traditional knowledge. Therefore, pottery making offers an innovative and practical approach to science education that not only strengthens conceptual understanding but also supports sustainable and culturally relevant learning experiences.

Keywords

Pottery Making; Scientific Concepts; Sustainable Practices; Experiential Learning; Traditional Knowledge.

TSC26020

INNOVATIVE METHODS OF TEACHING PHYSICS FOR HIGHER SECONDARY EDUCATION

Huidrom Santosh Singh
Little Master English Higher Secondary School, Shamurou
Email: santoshhuidrom737@gmail.com

ABSTRACT

Physics is a fundamental science that helps students understand natural phenomena and develop analytical thinking. However, traditional lecture-based teaching methods often make physics appear difficult and abstract to higher secondary students. Therefore, adopting innovative teaching methods is essential to improve students, understanding, interest, and participation in the subject.

Innovative methods such as **activity-based learning, demonstration experiments, simulation tools, project-based learning, and the use of multimedia technology** can significantly enhance the effectiveness of physics teaching. Activity-based learning encourages students to explore concepts through hands-on experiments and group activities, allowing them to connect theoretical ideas

with real-life experiments. Demonstration experiments performed in classrooms help students visualize physical principles such as motion, waves, electricity and magnetism.

The integration of **digital tools and simulations,** such as virtual laboratories and interactive animations, provides students with opportunities to observe complex phenomena that may not be easily demonstrated in classroom laboratory. Project-based learning also promotes creativity, teamwork, and problem-solving skills as students work on real-world physics applications.

Another important approach is the **use of inquiry-based learning,** where students are encouraged to ask questions, formulate hypotheses, and investigate scientific problems independently. This method develops scientific thinking and improves conceptual understanding. In addition, the use of **graphs, diagrams, models and concept maps** helps simplify abstract concepts and makes learning more engaging.

In conclusion, innovative teaching methods play a crucial role in improving the quality of physics education at the higher secondary level. By combining traditional teaching with modern technologies and student-centered strategies, teachers can make physics more interesting, understandable, and relevant to students everyday lives. These approaches not only improve academic performance but also inspire students to develop a deeper interest in science and research.

TSC26021

STUDY ON THE VARIOUS SCIENCE PROMOTION ACTIVITIES AND PROGRAMMES AT SCHOOL LEVEL UNDER THE THEME INNOVATIVE SCIENCE EDUCATION FOR A SUSTAINABLE FUTURE

THINGBAIJAM JOTIN SINGH
S.G.T., LANGMEIDONG HIGHER SECONDARY SCHOOL
Email: jotin19751010@gmail.com

ABSTRACT

The overall development of a country or a region largely depends on Science and Technology. Science Education which is the key foundation of Technological Advancement is central to sustainable development in all aspects social, economic, environment, health, water, agricultural productivity, defence and space exploration.

None of the millennium development goals (MDGs) can be met without innovative Science Education followed by Creative Technology and Research. Currently various innovative Science promotion Activities and programmes are taking place at school level. Various innovative, creative scientific activities and programmes that ignite the young minds at the school level includes, Science quiz, Science Debate, Science clubs, Maths club, Eco clubs, Science, Mathematics & environment exhibition, and National Childrens Science Congress and Vikshit Bharat Buildathon. In order to ignite the young minds along with creative and innovative ideas, Various flagship programmes like establishing Atal Tinkering Labs, Atal incubation centres Under Atal Innovation Mission of NITI Ayog are launched way back in 2016. Despite the various Activities and programmes, the no. of students and mentors that took part in then activities and programme are very limited (Less than 5% of the students enroll in high school and higher secondary level). In order to Attract Maximum participation of the students along with great enthusiasm and zeal a comprehensive approach in Science education for future sustainability is required. The need of the hour is introduction of suitable compulsory Scientific projects and activities in the school curriculum for every students reading in high and higher secondary level which should carry at least 20% weightage in their Final grading.

TSC26022

INNOVATIVE SCIENCE EDUCATION FOR A SUSTAINABLE FUTURE

Hidangmayum Jima Devi
Lecturer Chemistry, Little Master Eng Hr. Sec. School
Email: jimadevi777@gmail.com

ABSTRACT

The future of the world depends on how effectively we educate the next generation of scientists, innovators and thinkers. The present day world is facing many global challenges such as resource depletion, various types of pollutions, climate change, food and water insecurity, pandemics etc.

Traditional science education often overemphasized on rote memorisation rather than proper understanding and falls short in equipping students with the skills and mindset needed to tackle the global challenges. Hence, science education needs to evolve beyond this traditional framework to foster critical thinking and problem

solving skills to the students. To achieve these goals, an interdisciplinary approach is much needed. Science and technology should be combined with disciplines such as humanities, mathematics etc to provide better understanding to the students.

Young students should be given proper awareness about the real world situations, its impact on the environment and living beings, methods to tackle such problems. For this, traditional classroom teaching methods should be accompanied with field trips, hands on experiments, virtual laboratories, AI assisted visuals, and AI-driven simulations. This will provide better understanding of complex concepts and encourage active participation of learners in teaching learning process.

Project and model based teaching also proved to be one of the most effective teaching method. For example, a mini model of water purification system or rain water harvesting will encourage young minds to develop ideas to tackle the problem of water scarcity. Models to generate renewable or green energy like windmill, or solar panels, hydro power project can also instill a thought on solutions to reduce stress on non-renewable energy. AI generated visuals can be used to show the problems and impacts of various types of pollutions to instill the ideas of eco friendly practice.

Partnership with local organisations and industries can also ensure context relevant impactful solutions. Collaborative studies with the students, educators, researchers of different institutions through workshops, seminars and group projects can also enhance the knowledge of and skills to address real world problems.

Our aim of science education should be to inspire a generation of eco-conscious scientists, scholars and leaders equipped with mindset and knowledge to address the complex sustainability challenges we are facing.

TSC26023

SCIENCE EDUCATION AS A TOOL FOR HUMAN UPLIFTMENT AND SUSTAINABLE LIFESTYLE

Kongbrailatpam Nanda Devi
Keishamthong High School, Keishamthong Elangbam Leikai
Email: nandakongbrailatpam@gmail.com

ABSTRACT

This project presents an innovative view of science education as a powerful means for complete human development and sustainable living. Science education should not remain limited to textbooks, formulas, and laboratory work alone. It should also help learners understand health, hygiene, nutrition, environmental protection, responsible use of resources, and the practical application of science in daily life. In this way, science becomes not only a subject of study but a guide for better living.

The innovative idea of this project is that education should awaken the hidden innate qualities already present within every human being. Along with observation, reasoning, and experimentation, science education can be enriched by meditation, reflection, and sense-awareness. Meditation in education helps calm the mind, improve concentration, sharpen observation, strengthen self-control, and bring out inner qualities such as discipline, patience, compassion, creativity, and clarity of thought. This makes learning deeper, more meaningful, and more transformative.

The project also highlights inclusive learning. Even blind learners can understand and share scientific knowledge through touch, hearing, smell, and other senses. This teaches us that true learning depends not only on eyesight, but on awareness and proper use of the senses. In fact, those who are not blind often face more distractions, so education should help all learners use their senses positively and consciously.

It is also important to understand that body, mind, and environment are closely connected. When the body is unhealthy, the mind becomes restless; when the environment is polluted, human well-being also suffers. Therefore, science education should promote healthy living, inner discipline, environmental harmony, and sustainable habits. Thus, science education becomes an innovative path toward human upliftment, awakening of hidden potential, self-discipline, and a sustainable future.

Science education should not only teach us about the world outside, but also awaken the hidden greatness within us.

TSC26024

TRENDS IN SCIENCE EDUCATION

Avinay Prasad
DR. Thouma High School, Pherzawl
Email: avinayprasad92@gmail.com

ABSTRACT

Education is rapidly evolving due to technological advancement, social challenges and new learning demands. The future of education is shaped by various technological, demographic, economic and political trends that influence the way of teaching and learning that take place in modern institutions. Technological trends encourage the use of digital tools and online platforms to enhance the learning process. It enables personalized instruction, adaptive learning systems and increased teacher student interaction. It provides opportunities for student collaboration and internships. Demographic friends highlights the need for bilingual resources, culturally responsive pedagogy and flexible learning pathways that address diverse learner needs and support self-directed learning. Economic trends also play a crucial role in shaping educational planning and implementation. Differences in funding across destructs and limited resources require schools to pursue grants and careful budget planning to invest in professional development and teacher training. Political trends influences guide educational priorities through state and local policies that determine student success goals, curriculum revisions and assessment factices. To respond effectively these trends, educational institutions must adopt a clear vision and implementation plan. This includes engaging all stakeholders in decision making processes strengthening faculty leadership structures, providing ongoing professional development for teachers and integrating innovative approaches such as BYOD, blended learning, flipped classroom and technology supported instruction. These approaches help students to develop important 21st century skills such as critical thinking, creativity, communication and problem showing. In addition providing learners with hands on experience with technological tools such as digital platforms, stimulations and collaborative applications enhances engagement and enables students to develop essential digital competencies and 21st century skills. The future of education lies in embracing technological innovation, promoting inclusive and student centered learning and fostering collaborate among stakeholders. By adapting to these trends, educational institutions can create meaningful learning experiences that prepare students for a dynamic and rapidly changing world.

TSC26025

A STUDY ON THE USAGES OF *MELOCANNA BACCIFERA* AT LEIBI VILLAGE, TENGNOUPAL DISTRICT, MANIPUR

DL. MESHIL MARING
SGT, Parengtong Jr. High School, Tangnoupal
Email:

ABSTRACT

Melocanna Baccifera is known as Moubi-wa in Manipuri. It is grown at Leibi, Kwatha, Lokchao, Chandel Tamenglong, Bishempur and many other places of Manipur. They are bio-degradable, so items made by these bamboos can decompose easily unlike plastic items when thrown away. Moreover, they can also grow within a year even if the stem is cut. So, once planted they grow and expanded easily to surrounding areas unlike other bamboos, which make an ideal solution for daily use and consumption.

Melocanna Baccifera are used for making roofs, walls and fencing of the house. It is used for making basket, stool (mora), chair, table, drinking cup, ladle, fork, spoon, mat, ropes, Umbrella and fishing hook. It is also used in making bridge, climbing ladder, torch at night, water storage and carrying water at the hills. The villagers eat its shoots in fresh and also after fermented. Bamboo forest are the homes for many birds and rodents which were the food for the villagers. One third of the land of Leibi is covered by Moubi forest. Thus, it is the great source of oxygen for them.

TSC26026

ROLE OF ECO-CLUBS IN PROMOTING SUSTAINABLE SCIENCE EDUCATION: A DESCRIPTIVE STUDY OF SCHOOLS UNDER ZEO WANGOI, MANIPUR

Aribam Nilkant Sharma
Graduate Teacher-Science
Samurou High School,Imphal West, Manipur
nilkant35@gmail.com

ABSTRACT

The growing urgency of environmental challenges has repositioned school education as a critical site for fostering sustainable behaviour. In India, eco-clubs have been institutionalised as participatory platforms to promote environmental awareness, while Mission LiFE (Lifestyle for Environment) emphasizes behavioural transformation through everyday practices. This study examines the role of eco-clubs in advancing Mission LiFE within science education in selected schools under ZEO Wangoi, Imphal West District, Manipur.

A descriptive research design was adopted using primary data collected from teachers associated with eco-club activities. Data were gathered through structured questionnaires and supported by observational insights. Analytical techniques included percentage analysis and thematic interpretation.

The findings indicate that eco-clubs significantly enhance environmental awareness, student participation, and attitudinal orientation towards sustainability. However, the translation of awareness into sustained behavioural change remains partial. While students demonstrate improved practices such as waste segregation and reduced plastic usage within school contexts, the continuity of these behaviours beyond institutional settings is inconsistent. Awareness of Mission LiFE is relatively high, yet its systematic integration into school-level practices is limited.

The study identifies key constraints including inadequate resources, limited teacher training, time constraints, and weak community involvement. It concludes that eco-clubs function effectively as awareness-generating mechanisms but require structural strengthening to operate as behavioural transformation systems aligned with Mission LiFE. The paper recommends institutional support, pedagogical integration, and community linkage to enhance impact.

Keywords: Eco-clubs; Mission LiFE; Sustainable Science Education; Environmental Behaviour; Experiential Learning; School Education.

TSC26027

INTEGRATING EDUCATION FOR SUSTAINABLE DEVELOPMENT TO IMPROVE THE TEACHING OF SCIENCE AND SOCIETY IN SCHOOLS

Khuraijam Dhananjoy Singh
Lecturer (Engg. Drawing), Ananda Singh Higher Secondary Academy, Imphal- East
Emails: chkdsingh786@gmail.com

ABSTRACT

The United Nations Sustainable Development Goals (SDGs), adopted in 2015, present a comprehensive framework of 17 global priorities aimed at achieving a sustainable, equitable, and prosperous future by 2030. Central to these goals is Education for Sustainable Development, particularly reflected in SDG 4 (Quality Education), which emphasizes the transformative role of education in addressing global challenges such as environmental degradation, social inequality, and economic instability. This study highlights the significant contributions of Indian thinkers such as B. R. Ambedkar, Mahatma Gandhi, Rabindranath Tagore, and Sri Aurobindo, whose philosophies align with sustainability, social justice, and holistic education. Their ideas, along with the reformist efforts of Jyotirao Phule, Savitribai Phule, and Pandita Ramabai, provide a strong foundation for inclusive and value-based education. The study emphasizes the need to move beyond traditional, lecture-based teaching methods toward experiential and participatory learning approaches. Strategies such as school-based projects, game design, and digital collaboration enhance student engagement and promote deeper understanding of sustainability concepts. Innovative pedagogies, including sensory and arts-based approaches, further enrich learning by fostering emotional connection, creativity, and critical reflection. In the context of contemporary global challenges, including environmental crises and the COVID-19 pandemic, the study advocates for curriculum reforms that integrate sustainability across disciplines. It also underscores the importance of developing critical thinking and action competence, drawing on the educational philosophy of John Dewey, who emphasized reflective learning as essential for democratic and transformative education. The findings suggest that an overemphasis on factual knowledge may limit opportunities for collaborative and critical learning. Therefore, strengthening teacher training□ both pre-service and in-service□ is crucial for effectively implementing education for sustainable development. The study ultimately aims to inspire and

empower educators to adopt innovative teaching practices, thereby nurturing environmentally responsible individuals capable of contributing to a sustainable future.

In conclusion, achieving SDG 4 is both a challenge and an opportunity. By integrating inclusive philosophies, experiential learning, and critical thinking into education systems, societies can empower individuals and support the achievement of all SDGs, active participation of policy makers, teachers and students, ensuring a sustainable future for all.

Keywords: Sustainable development, environment sustainability, schools.

TSC26028

BIOPLASTICS

Naorem Bembem Devi
Tamphasana Girls Higher Secondary School
Email: naorembembemdevinaotem@gmail.com

ABSTRACT

Nowadays, plastic materials are mostly made from fossil resources, and they are characterized by their long lifetime and pronounced persistence in the open environment. These attributes of plastics are one cause of the ubiquitous pollution we see in our environment. When plastics end up in the environment, most of this pollution can be attributed to a lack of infrastructure for appropriately collecting and recycling plastic waste, mainly due to mismanagement. Because of the huge production volumes of plastics, their merits of being cheap to produce and process and their recalcitrance have turned into a huge disadvantage, since plastic waste has become the end point of our linear economic usage model, and massive amounts have started to accumulate in the environment, leading to microplastics pollution and other detrimental effects. A possible solution to this is offered by bioplastics, which are materials that are either (partly) biobased and/or degradable under defined conditions. With the rise of bioplastics in the marketplace, several standards and test protocols have been developed to assess, certify, and advertise their properties in this respect. This article summarizes and critically discusses different views on bioplastics and for sustainable future, mainly related to the properties of biodegradability and biobased carbon content; this shall allow us to find a common ground for clearly addressing and categorizing bioplastic materials, which could become an essential building block in a circular economy. Today, bioplastics account

for only 1–2% of all plastics, while technically, they could replace up to 90% of all fossil-based plastics, particularly in short-lived goods and packaging, the single most important area of use for conventional plastics. Their replacement potential not only applies to thermoplastics but also to thermosets and elastomers. Bioplastics can be recycled through different means, and they can be made from renewable sources, with (bio)degradability being an option for the mismanaged fraction and special applications with an intended end of life in nature (such as in seed coatings and bite protection for trees). Bioplastics can be used in composites and differ in their properties, similarly to conventional plastics. Clear definitions for "biobased" and "biodegradable" are needed to allow stakeholders of (bio)plastics to make fact-based decisions regarding material selection, application, and end-of-life options; the same level of clarity is needed for terms like "renewable carbon" and "bio-attributed" carbon, definitions of which are summarized and discussed for sustainable future in this paper.

TSC26029

SCIENCE EDUCATION FOR SUSTAINABLE DELOPMENT IN HIGH SCHOOL

Aribam Swastika Devi
SGT, Wangkhei High School
Email: swastikaaribam@gmail.com

ABSTRACT

The challenges of the 21st Century from climate change to resource depletion, demand a shift in how we approach progress. To build a sustainable future, we must move beyond traditional rote learning and embrace innovative science education. This approach empower the next generation not just to understand the world, but to actively protect and improve it.

Innovative science education focuses on hands on, enquiry base learning. Instead of memorizing facts from a textbook, students can engage in real world problem solving. For example, learning about renewable energy becomes more impactful when students build their own miniature electric charkhas. This practical experience fosters critical thinking and creativity essential skills for developing the green technologies of tomorrow.

Furthermore, biology classes can explore biodiversity conservation and sustainable agriculture, while chemistry, can focus on practical like water testing and for physics we can observe natural phenomenon like solar and lunar eclipse, observing of constellation. By connecting scientific principles to environmental ethics, education helps students realize that every scientific advancement must be weighed against its long term impact on the planet.

Keywords: **Sustainable, Renewable energy, green technology, Biodiversity.**

TSC26030

TEACHING SCIENCE FOR A SUSTAINABLE FUTURE: LINKING SDGs

Yumnam Tamphasana Devi
Oinam Government Higher Secondary School, Oinam
Email: y.tamphasanachanu@gmail.com

ABSTRACT

Innovative science education is essential in addressing the complex and interconnected challenges of sustainability in the modern world. Traditional methods of teaching, which often emphasize rote learning and theoretical knowledge, are insufficient to equip learners with the competencies required to respond effectively to real world environments and societal issues. Therefore, a shift towards innovative, learner-centered approaches in science education is critically needed.

To build a sustainable future, science education must evolve from a static body of facts to a dynamic, action-oriented discipline that empowers learners as agents of change. The United Nations in 2015 set a collection of 17 global goals as a part of the 2030 agenda for sustainable development. SDGs (Sustainable Development Goals) are included in School curriculum to build responsible citizens, create awareness of real world problems, develop life skills, connect learning to life, and shape a better future. It can be integrated across all subjects, including core and co-curriculum areas. Schools can also take up some practical steps to implement SDGs holistically by hosting, thematic assemblies and School events. We will face some common challenges in implementing SDGs in our curriculum. Addressing these challenges requires policy support and institutional commitment.

Science education is a key driver for achieving the SDGs by fostering critical thinking, evidence based decision making and technological innovation needed to solve complex global challenges. This paper explores how CBSE circulars, guidelines, and programs promote SDG-based education. By adopting innovative teaching methods and integrating sustainability into the curriculum, educators can empower students to contribute meaningfully to global sustainability goals.

TSC26031

POPULARIZATION OF MATHEMATICS AMONG TRIBAL STUDENTS IN THE TAMENGLONG CONTEXT

Singongpou Pamei
SGT, Tamenglong Hr. Sec School, Tamenglong
Email: pksingongpou@gmail.com

ABSTRACT

The popularization of mathematics among tribal students in Tamenglong district presents both a challenge and an opportunity for inclusive educational development. Mathematics is often perceived as abstract and difficult, particularly among tribal learners who may face linguistic barriers, limited access to resources, and a disconnect between the formal curriculum and their lived experiences. This study explores strategies to make mathematics more engaging, relevant, and accessible within the socio-cultural context of Tamenglong.

The paper emphasizes the importance of culturally responsive pedagogy, where mathematical concepts are linked to indigenous knowledge systems, daily activities, and local practices such as agriculture, trade, and craftsmanship. By integrating familiar contexts, learners can better relate to mathematical ideas, thereby reducing anxiety and improving comprehension. The role of teachers is crucial in this process, requiring capacity building, innovative teaching methods, and the use of activity-based and experiential learning approaches.

Furthermore, the study highlights the need for community involvement and the use of local languages as mediums of instruction in early education. Initiatives such as math clubs, games, storytelling, and the use of low-cost teaching aids can significantly enhance interest and participation. Technology, when accessible, can also serve as a supportive tool in visualizing and simplifying complex concepts.

The findings suggest that the popularization of mathematics is not merely about curriculum delivery but about transforming perceptions and creating a supportive learning environment. Addressing socioeconomic constraints, improving infrastructure, and ensuring policy support are also critical components.

In conclusion, making mathematics meaningful and enjoyable for tribal students in Tamenglong requires a holistic approach that blends cultural relevance, pedagogical innovation, and community engagement, ultimately fostering confidence and long-term academic success.

TSC26031

EFFECTIVE METHODS OF TEACHING MATHEMATICS

T. JAYANTA SINGH
Lecturer, Sagang Hr. Sec. School Churachandpur District

ABSTRACT

There are different methods of teaching mathematics. Some of the methods used in our schools are mainly (a) Lecture Method (b) Inductive-Deductive Method (c) Analytic-Synthetic Method (d) Demonstration Method (e) Lecture-cum-Demonstration Method, so on.

The teacher can choose a method on his convenience in the process of teaching and learning of a particular topic. Generally we can use more than one method in teaching a topic. Effective learning of mathematics involves an active, constructivist approach where students discover concepts by observing, formulating hypotheses and testing ideas.

So, in the process of teaching and learning mathematics, not only asking questions having specific answer we can also ask questions having more than one answer. That means questions having multiple answers. Let the students create problems and its solution also. It would help the students in developing and understanding of the concepts and principles of Mathematics. Knowledge of mathematics will develop logical reasoning, abstract thinking, imagination and mental ability. mathematical modelling, enquiry and experimentation to build problem-solving skills are important. In this digital world there are many softwares and YouTube channels, it helps in learning mathematics.