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Special Issue

on

NURTURING RESEARCH AND INNOVATION ECOSYSTEM

on the occasion of

AIU CENTRAL ZONE VICE CHANCELLORS' MEET–2023-24

hosted by

Guru Ghasidas Vishwavidyalaya, Bilaspur

on

JANUARY 18-19, 2024

Association of Indian Universities
New Delhi

&

Guru Ghasidas Vishwavidyalaya
Bilaspur

Welcome

The Delegates

of

AIU Central Zone Vice Chancellors' Meet–2023-24

(January 18-19, 2024)

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EDITORIAL

Best Will Definitely Come!

India is rushing headlong toward towards becoming *Vikasit Bharat* in 2047, counting on high-tech industries and high-quality research institutions and universities to propel the nation toward prosperity and power. To realise this vision, Research, and Innovation are the key elements. The role of research and innovation in creating new knowledge is crucial to addressing the fundamental challenges related to demography, disparity, and development. Knowledge, education, and innovations are critical to providing opportunities for the poor and underprivileged to reduce disparities in our society. These are equally important to expedite the process of development and improve productivity, and efficiency, and reduce costs. Universities ought to be one of the major contributors to scientific research leading to invention and innovation in the world. Higher Education Institutions not only have the specific responsibility of conducting Research and Innovation but also preparing Researchers and Innovators for the Nation.

India has significant advantages in the 21st-century knowledge race. It has a large higher education sector — the third largest in the world with around 40.15 million students and 15.12 million teachers. The Country has the unique advantage of a demographic dividend. It is reportedly home to more than 600 million people aged between 18 and 35, with 65% under the age of 35. India's demographic dividend is expected to persist at least until the year 2055–56 and will peak around 2041 when the share of the working-age population — 20–59 years — is expected to hit 59%. English is extensively used in higher education and research. There are several high-quality institutions, departments, and centers that can form the basis of the quality of research in the country. However, India will need to create a dozen or more universities that can compete internationally to fully participate in the new world economy, for which the National Education Policy–2020 has also advocated.

Research is a great human endeavor. It requires a lot of paraphernalia to accomplish good research. Most importantly, it requires trained human resources with the aptitude and ability to do research and the availability of research facilities. Research Facilities involve a range of things from political will to peer support. Research efficiency and output depend upon Government support, administrative leadership, academic intent, public opinion, heavy funding, and adequate infrastructures like laboratories, libraries, and access to digital and computational resources. Good research is only possible when research is valued, supported, and provided with the required autonomy. The importance of good research for the economic and social well-being of a society is reflected in the magnitude of financial resources available for the purpose. Good research cannot be done cheaply; it often needs a great deal of money. Ethical standards are very significant for maintaining the integrity, openness, and transparency of the research process, and to safeguard intellectual property. Most importantly, a conducive culture needs to be developed by developing a habit of research and documentation from the school level itself. If Research is carried out effectively innovation becomes inherent. We use 'innovation' in a broad sense, that is, as the creation of something new: an idea, a concept, a way of

looking at things, a method or approach for the development of novel things for practical applications, which can be marketed for commercial purposes.

In India most often, these conditions are not met so the country is lagging in Research, particularly in university Research. University Research system involves a community of researchers that interacts with one another, their environment, and other stakeholders interested in their respective areas of research in such a way that knowledge is transferred between them and system-level processes emerge. Such a system if arranged in the form of an ecosystem for effective delivery can be called a Research and Innovation Ecosystem. The concept of Research and Innovation Ecosystem is derived from the broader term 'Ecosystem' that is a community of living organisms i.e. plants, animals, and microbes in conjunction with the nonliving components of their surroundings like air, water, minerals, and soil, interacting as a system. The Ecosystem provides a conducive climate required for cohabitation of all living organisms which has a varied requirement for survival. The concept applies to the Research ecosystem where the beginners who are young and fresh get a supportive environment to prove their mettle and the matured, experienced faculty members and researchers also get an enabling condition to prosper. In the process of research ecosystem, interaction among various stakeholders assumes the most important role. The Research Ecosystem of a University can be summed up as an interacting system of well-knitted inner and outer components.

It is obvious that India cannot build internationally recognised research-oriented universities overnight, but the country has the key elements in place to begin and sustain the process which gives a lot of hope.

In this grand feat of creating Research and Innovation Ecosystem, one truth stands tall—we're on the cusp of a revolution that promises to be extraordinary. *So, brace yourselves: the best will definitely come!*

Sistla Rama Devi Pani

Setting the Tone for AIU Central Zone Vice Chancellors' Meet on Nurturing Research and Innovation Ecosystem

Pankaj Mittal* and Sistla Rama Devi Pani**

The Association of Indian Universities (AIU), one of the premier higher education institutions in India, was established in 1925. It plays a vital role in shaping Indian higher education by being a research-based policy advice institution to the Government of India in the fields of Higher Education, Sports, and Culture. One of the key activities of the AIU is to convene the Vice Chancellors' Meets at the Zonal and National levels to discuss various issues related to higher education. India is a country with a large geographical area, for ease of reaching out, AIU has grouped the member HEIs into 5 zones—East, West, North, South, and Central. Each zone is constituted of HEIs located in 5-6 States grouped in that Zone. Thus, 5 Zonal Meets and one National Vice Chancellors' Meet are organized annually. These Meets are important platforms not only to discuss the significant issues of higher education but also to play a catalytic role in finding solutions for different problems of higher education through collective wisdom. Further, AIU carries forward the voice of the participating leaders of higher education to appropriate agencies and authorities for their dispensation. Every year in the Annual Vice Chancellors' Meet, a specific theme that is of topical significance for the higher education community is taken up for discussion. As a run-up, subthemes related to the main theme are discussed in the Zonal Vice Chancellors' Meets.

AIU Vice Chancellors Meet –2023-24

Projecting the landscape of higher education in the year 2047 shall involve a lot of speculation, as the future will depend upon the complex interplay of social, technological, economic, and cultural factors. Based on current trends and potential developments, it is the right time to discuss on theme related to prospective Higher Education in 2047, to provide a glimpse into the potential directions higher education could take by the year 2047, when India celebrates 100 years of independence. The *Amrit Kaal* from 2022 to 2047 holds a lot of potential, in terms of shaping our higher education to meet the challenges of the 21st century. Therefore, for the year 2023-24, AIU has chosen the main theme as **'Higher Education@2047'.** Under this overarching theme, the following themes are proposed for the AIU's Zonal Conferences:

North Zone: ***Globalization and Internationalization of Higher Education***

South Zone: ***Digital Transformation in Higher Education***

East Zone: ***Integrating Bhartiya Knowledge System (BKS) with Higher Education***

West Zone: ***Future of Work and Skill Development***

Central Zone: ***Nurturing Research and Innovation Ecosystem***

Central Zone Vice Chancellors' Meet on '*Nurturing Research and Innovation Ecosystem'*

Nurturing a healthy research and innovation ecosystem is very important for the advancement of societies, and economies, and for the progress of human knowledge which nurtures creativity, drives technological advancements, and addresses various complex challenges.

By integrating elements like policy and funding support for research and innovation and its infrastructure, development of the student's talent, promoting collaboration between academic and industry, encouraging entrepreneurship and Startups, etc. where governments, academia, industries, and communities may collectively nurture a dynamic research and innovation ecosystem which drives towards economic growth, societal development, and technological breakthroughs. The two-day event

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will include the following 3 Technical Sessions to discuss the concerned topics:

i. **Technical Session--1: Collaborative Research Networks: Fostering Inter-disciplinary Research**

ii. **Technical Session-2*:* Entrepreneurship and Innovation: From Idea to Impact**

iii. **Technical Session-3*:* Innovative -funding models for Research**

Collaborative Research Networks: Fostering Inter-disciplinary Research

Collaborative research networks facilitate collaboration, information exchange, and the pooling of resources to address complex research questions, advance knowledge, and promote interdisciplinary cooperation. They can operate at local, national, or international levels and can focus on a wide range of disciplines and topics. It creates opportunities for researchers to work beyond the confines of their institutions and disciplines, contributing to the growth and impact of research on a larger scale.

Interdisciplinary research encourages researchers to combine their expertise, methodologies, and perspectives to develop innovative solutions that may not be achievable within the confines of a single discipline. Fostering interdisciplinary research requires a commitment from institutions, researchers, and funding agencies to break down traditional disciplinary boundaries and embrace collaborative and innovative approaches. The resulting insights and solutions have the potential to drive significant advances in various fields and address complex societal challenges.

This theme would explore the power of collaborative research networks in driving innovation across disciplines. Discussions might cover topics such as effective methods for building interdisciplinary research teams, best practices for cross-sector partnerships, and case studies of successful collaborative research initiatives.

Entrepreneurship and Innovation: From Idea to Impact

Entrepreneurship and innovation work like a driving force for economic growth, creating new industries, and solving societal challenges. Fostering entrepreneurship and promoting innovation prepares students to be innovative thinkers, problem solvers, and potential entrepreneurs. Promoting entrepreneurship and innovation not only benefits students and faculty but also contributes to economic development and the creation of new ventures that can have a positive impact on society. By providing the right support, education, and resources, higher education institutions can cultivate a thriving ecosystem of innovation and entrepreneurship on campus.

In this session, the discussion will focus on the process of turning research and innovative ideas into real-world impact. Conference sessions might cover topics such as technology transfer, startup incubation, funding opportunities for innovative projects, and the role of higher education institutions in nurturing an entrepreneurial culture.

Innovative -funding Models for Research

Funding is one of the crucial aspects of any kind of research activity as it involves huge expenditure. Similarly, innovation is vital not only in research itself but also in the way research is funded. Models of traditional funding may sometimes not be sufficient in addressing the rapidly changing research landscape.

It is also a significant factor that each research project needs specialized funding model. However, the success of the funding model often depends on effective communication, transparency, and the ability to convey the potential impact of the research to potential funders. Hence, in this session, the discussion will focus on the deliberation of various innovative funding models for the research and its implications.

Participation and Organization

Vice Chancellors of Indian Universities, Experts from the Government of India, Apex Bodies of Higher Education, and Academia will be speakers and Session Chairs. Experts from international organizations will also be invited to contribute. Discussions will be conducted in English. Sessions will be in a blended mode.

Format and Approach

The Sessions will be of 1 Hour and 30 Minutes each. In each Session, there will be experts from

Government, HEIs, etc. Presentations will be followed by interaction and Q and A. Based on deliberations; a commitment statement will be framed for the universities to further the cause of Higher Education in India. In addition to academic deliberations, capacity development initiatives will be taken by forming a group of Vice Chancellors who will work on various dimensions of nurturing the Research and Innovation Ecosystem. The discussions in the Meet will primarily focus on the steps to nurture the Research Ecosystem in Indian universities; address key issues involved in creating Collaborative Research Networks and Fostering Interdisciplinary Research; Promoting Entrepreneurship and Innovation; and finding Innovative -funding Models for Research.

Conclusion

Given the increased expectations on the Higher Education System for research, there is a strong need to come up with an efficient Research and Innovation Ecosystem and nurture it carefully. Immediate action, therefore, is required in all Indian higher education institutions to take all initiatives to create a Research and Innovation ecosystem that can lead to efficient and strong industries in 2047.

The recommendations of this Conference will constitute the discussions in the Annual Meet. On the basis of the recommendations of this National Seminar, '*University Action Plan on creating Research and Innovation Ecosystem in Higher Education'* will be prepared which will be a handy guide for Higher Education Institutions of the Country. A Policy Document will also be prepared and presented to the Government of India.

We anticipate a fruitful and meaningful interaction toward the resolution and realization of a common agenda for academic excellence through transformative higher education. This Vice Chancellor's Meet is but a steppingstone in the direction of building a new higher education system to build the New India. ❑

Sophisticated knowledge of the natural world is not confined to science. Human societies all across the globe have developed rich sets of experiences and explanations relating to the environments they live in. These' other knowledge systems 'are today often referred to as traditional ecological knowledge or indigenous or local knowledge. They encompass the sophisticated arrays of information, understandings, and interpretations that guide human societies around the globe in their innumerable interactions with the natural milieu: in agriculture and animal husbandry; hunting, fishing, and gathering; struggles against disease and injury; naming and explanation of natural phenomena; and strategies to cope with fluctuating environments.

– Nakashima, D., Prott, L. and Bridgewater, In Tapping into World's Wisdom, UNESCO

Guru Ghasidas Vishwavidyalaya, Bilaspur: A Profile

Guru Ghasidas Vishwavidyalaya, Bilaspur is hosting the Central Zone Vice Chancellors' Meet of the Association of Indian Universities scheduled to be held during January 18-19, 2024.

Guru Ghasidas Vishwavidyalaya (GGV), Bilaspur, Chhattisgarh, India, established as a State University under Madhya Pradesh Vishwavidyalaya Adhiniyam-1973 was upgraded to Central University on 15th January 2009 by the Central Universities Act, 2009 (No. 25 of 2009). It is one of the leading institutions of higher education in the country situated in the Schedule – V area of Central Tribal Belt in Chhattisgarh. This University is permanent member of the Association of Indian Universities and Association of Commonwealth University.

It is a residential University spread over 655.76 acres of land with a buildup area of approximately 201450.97 Sq m. The lush green campus, having a wide variety of flora and fauna, wild life, microbes, etc., exhibits an enriched biodiversity.

The University has been imparting quality higher education through its 32 academic departments under 11 Schools of Studies. In the academic session University offers 114 academic programmes with 10335 enrolled students. Our efforts for sustaining the Research and Development have resulted into research funding of more than Rs. 2900.00 lakhs emanating from both governmental as well as non-governmental sources. The concerted efforts resulted into 3600 outcomes with excellent pass out percentage, placement, progression, publications, patents, and collaborations.

In addition, the learners are engaged in effective societal transformation through Unnat Bharat Abhiyan (UBA), NSS, NCC, Ek Bharat Shreshtha Bharat (EBSB) and On-Campus initiatives such as GGV Swabhiman Thali (GST), Swalambi Chhattisgarh, GGV Shravan Line (GSL), GGV Pyau Service (GPS), Vruddhashram, Day Care Centre (Kilkari), GGV Healthy University Movement (HUM) and GGV Natraj Kala Manch (NKM).

The University, in pursuit of contributions towards national development, has successfully supported 20 startups.

The University has emerged as a leader in the effective implementation of NEP-2020. We have attained significant achievements including 100% registration on Academic Bank of Credits (ABC) portal and incorporating ABC with multiple entry and exit options, Multidisciplinary, Flexible and Holistic education, incorporating Indian Knowledge System (IKS) components and extra-curricular elements into four years Under Graduate Programmes. This is in line with the NEP vision of evolving learners deep rooted with Indian traditions and bearing the flags of advanced 21st century skills. In addition, flexibility is also provided by offering maximum 40% choice of the courses in the curriculum through MOOCs and blended mode learning opportunities from other institutions including ABC.

Vision

Motivated by the thoughts and teachings of Guru Ghasidas, a great Satnami Saint of the 18th Century, Guru Ghasidas Vishwavidyalaya, Bilaspur is committed to social empowerment, particularly of the weaker sections of the society, with the help of quality higher education and training. The focus of the University is on offering and strengthening innovative academic programs in emerging interdisciplinary areas of Science, Social Science, Engineering and Technology, Management, Commerce, Law, Pharmacy and Humanities with quality assurance so as to contribute to the growth of the knowledge base of the University in particular and of academia in general. The University aims to provide a value-based holistic education which will lead to the growth and development of a community better equipped to serve mankind.

Mission

The mission of Guru Ghasidas Vishwavidyalaya is to provide equitable, affordable and professionally relevant, quality higher education in a continuously changing global scenario. The aim is to develop citizens with knowledge, skills, and character who can contribute to national development meaningfully. The University endeavours to promote the concept of inclusive growth in higher education.

Objectives

- To disseminate and advance knowledge by providing instructional and research facilities in such branches of learning as it may deem fit;
- To make special provisions for integrated courses in Humanities, Social Sciences, Science & Technology in its educational programs;

- To take appropriate measures for promoting innovations in the teaching-learning process and interdisciplinary studies and research;
- To educate and train manpower for the development of the country;
- To establish linkages with industries for the promotion of science and technology; and
- To pay special attention to the improvement of the social and economic conditions and welfare of the people, and their intellectual, academic and cultural development.

Institutional Core Values

1. Developing character, ability, and creativity through adherence to academic integrity and human dignity
2. Striving for wisdom and excellence through knowledge and innovation with a specific thrust upon promoting regional/traditional knowledge and ethnic values
3. Instilling a spirit of entrepreneurship and innovation
4. Inculcating scientific ethos and democratic values
5. Promoting values such as tolerance, truth, forgiveness and Vasudhaiva Kutumbakam
6. Inculcating respect for cultural and social diversity
7. Encouraging expression of thoughts and ideas
8. Promoting access, equity and inclusiveness and developing a learner-centric academic ambience
9. Infusing national values and integration among learners
10. Promoting educational endeavours for achieving national developmental goals

Implementation of NEP-2020

All UG programmes have been restructured for multidisciplinary options (session 2022-23) and Curriculum of all PG programmes haven revised to incorporate outcome-based Curriculum Objectives, Programme Objectives and Program Specific Objectives. Apart from 29 programmes given by UGC, LOCF have also been implemented in all UG and professional programmes by mapping the Course Curricula with learning outcomes.

Four-year degree programmes curriculum framework has been designed for Science, Social Science, Arts, Commerce and other streams covering almost all dimension of education.

Sports, NCC, NSS, Yoga are made the integral part of programmes. Skill Enhancement Courses have been incorporated including AI/ML to increase the skill and innovation. Compulsory Internship seminar and other forms of experiential learning are included in these programme. Several value-added Courses have been started to supplement students interest beyond curriculum.

UGC regulation for ABC and multiple entry/ exit system are adopted and necessary restructuring of relevant ordinances is going on for credit transfer under ABC, course registration, etc.

University got registered in ABC and all students are motivated to get registered on ABC portal, examination forms are also redesigned to accommodate ABC registration id. Necessary statutory provisions for the implementations have been incorporated (These will be implemented once UGC notify)

Mahima Guru Ghair is established in order to propogate the ideas of Indian Saints and Scholars. Technology-enabled Learning Infrastructure (Smart Classrooms) and MOOCs Lab are upgraded for blended mode learning. Also state of the art MOOC laboratory has been developed capable of developing quality MOOCs programmes.

Research and Extension Activities

To promote frontier areas of research, the major and minor project funded by external agencies like UGC, DBT, DST, MoE&F, SCERT, ICMR, UGC-DAE-CSR. ICSSR, etc. are undertaken by various departments. During the session 2022-2023 Two departments namely Zoology and Mathematics funded DST-FIST grant. All the sanctioned projects are in operational. University is also promoting by organising National and International Seminar, Conference, Workshop, Symposium & Training programmes at regular interval. The national projects like NCERT, UGC-SAP.

Research and Instrumental Central facilities are created. One of the important facility in the Vishwavidyalaya is 3.0 MV Nuclear Accelerator centre which provide interdisciplinary research facilities. State-of-the-art Laboratory facilities is available in the Vishwavidyalaya.

Signing of Memorandum of Understanding

To establish strong linkages between International Organisations, Industries/Corporate Bodies/Education/ Research Institutions, NGO, other govt. and non-govt. agencies, Vishwavidyalaya has signed more than 125 MoUs. As per MoUs collaboration various

activities have been conducted/undertaken. One of the important MoU Vishwavidyalaya has signed with Gujarat University under flagship programme of Govt. i.e. Ek Bharat Shrestha Bharat wherein students from both the universities visit the various places and know about its culture, historical places, etc.

Physical Infrastructure

The Vishwavidyalaya is spread over 655.76 acres of land with lush and green campus. Garden meadows, tress and shrubs have been used according to a bio aesthetic plan to make the campus attractive. Various new buildings namely Girls Hostel Unit-I (G+4) 200 seats, Unit – II (G+4) 200 seats, Education Building (Horizontal Extension), Arts and Social Science Building (G+1), Commerce Department Building (G+1), Central Store & Workshop, Main Gate IT Workshop Building construction work have been completed and it is made functional. The construction of new buildings viz. Yoga and Meditation Centre, Civil Engineering Department (G+1), Mechanical Engineering Department Building (G+1), Extension of Boys Hostel Building , Electronics & Communication Engineering Department Building, Botany Department Building (G+1), Forensic Science and Anthropology & Tribal Department (FF) Building, Computer Science & Engineering Department Building (G+1), Chemical Engineering Department Building (G+1), Lecture Hall Complex (G+4), Extension of Girls Hostel and Boys hostels buildings. The construction of these buildings are in progress.

ERP: SAMARTH

Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh Implements Enterprises Resource Planning (ERP), SAMARTH from Ministry of Education, Delhi

SAMARTH is an e-Governance platform, developed under National Mission of Education in Information and Communication Technology Scheme (NMEICT) of M/o HRD. SAMARTH to enhance productivity through better information management in the institute by seamless access to information Ministry of Education (MoE) (Earlier Ministry of Human Resources and Development) has provided an e-Governance platform, SAMARTH (Enterprises Resource Planning) ERP, under National Mission of Education in Information and Communication Technology Scheme (NMEICT). ERP, SAMARTH, is an Open Standard Open-Source Architecture, Secure, Scalable and Evolutionary Process Automation Engine for Universities and Higher Educational Institutions. It caters to faculty, students and staff at a University/Higher Educational Institutions. Now, the ERP, SAMARTH, has been implemented at Guru Ghasidas Vishwavidyalaya (GGV). The objective of this initiative is to automate the processes of the Institute. Out of 45 Modules under SAMARTH, Organigram, Organizational Unit, User Management, Employee Management, RTI Management, Legal Case Management, Research Project Management, Examination modules, Essential services, Recruitment, Payroll, Leave Management, Minutes and Retrieval/Document, Fee Management, Programme Management, Knowledge Management, Inventory Management, Bill Tracking System, Training and Placement, Security, Academic Management, Procurement of Goods, sports have been implemented in Guru Ghasidas Vishwavidyalaya (GGV), the remaining are under process to implement.

Malviya Mission Teacher Training Center

UGC-Academic Staff College was renamed as UGC-Human Resource Development Centre (HRDC) in 2015 & Malviya Mission Teacher Training Center on 05th September, 2023. UGC-Academic Staff College (ASC) was established on the lush green campus of Guru Ghasidas Vishwavidyalaya (A Central University) on 27th March, 2009 to provide in-service training programmes for the faculty in various disciplines and plays a crucial role in the holistic development of teachers. The training programmes viz., Orientation programme, Refresher courses, short term courses, interaction programmes, workshops, seminars are regularly organized as per the guidelines of UGC, New Delhi. MMTTC has excellent class rooms with audio-visual, internet and multimedia facilities; providing an ambient environment for interactive learning. State-of-the- art Information Communication Technology (ICT) Laboratory with high-speed internet facilities further provides opportunities for participants to learn soft skills by hands on training from time to time during programmes. MMTTChas its own library with 967 numbers of book and digital resources to meet the needs of resource persons and participants. The Central library of the University also extends facilities of INFLIBNET, Science Direct, e-resources, books and journals to MMTTC. We have good facilities of guest house, medical and transport. Eminent academicians and researchers are invited as resource persons for delivering lectures in the training programmes, in addition to the senior faculty of the Vishwavidyalaya. The highly motivated faculty, state-of-the-art facilities, excellent logistics and ambience are the strengths of our MMTTC and key to the successful organisation of quality programmes.

Centre for Endangered Language

As per University Grants Commission, New Delhi letter No. F.No.15-6/2012(CU) dated 03 April, 2014, Guru Ghasidas Vishwavidyalaya has established Centre for Endangered Languas. The Centre has been working for the development of endangered Tribes languages/dialects through research, documentation and teaching. Presently, the Operational and Monitoring Committee has been constituted. A Professor of the Anthropology & Tribal Development has been appointed as Coordinator. Under the guidance of the Operational and Monitoring Committee, the major activities of the Centre are being carried out.

Dr Ambedkar Centre of Excellence (DACE)

Dr Ambedkar Centre of Excellence (DACE), Guru Ghasidas Vishwavidyalaya, is a free coaching centre for scheduled caste students funded by the Ministry of Social Justice and Empowerment of the Government of India. Dr. Ambedkar Centre of Excellence (DACE) is established with the strongest goal of serving the socially disadvantaged and instilling the culture of serving the nation and the community.

The centre offers coaching for the UPSC's preliminary and main examinations. The Ministry of Social Justice and Empowerment of the Government of India is funding the centre. Students are chosen for coaching through an entrance exam. They provide classroom instruction supplemented by periodic tests and evaluations. The university library is well-stocked with a wide range of subjects that are regularly replenished to give students access to current and relevant material.

Facilities for the Students

Dean Students Welfare

The Dean, Students Welfare Section of Guru Ghasidas Vishwavidyalaya, provides the essential information to students and parents throughout the year through the office, telephone, and helpline portals. The primary concern of the student welfare section has been to give information on every literary and cultural activity to students, ensure their active participation in these activities, take quick action regarding the solution of student-related problems, and have a cooperative attitude towards them.

Railway concession related documents

In Guru Ghasidas Vishwavidyalaya, there are not only local students but also a number of students from other states studying in the different departments. The office of Dean, student welfare provides railway concession form for students individually or collectively for them to visit their home town and for educational trip during vacation as per academic calendar.

Swipe Machine

The fee of transfer certificate, examination, hostel and other advance amount is deposited in the office of Dean, student welfare.

Other Student Welfare Schemes

Vishwavidyalaya has implemented 12 Student Welfare Schemes i.e. Merit Scholarship to one students from each School of Studies, Merit Scholarship to one student who secures higher score among all School of Studies, Amount facilitate to students participated in National Games/events, Participation in International Sports/Games/Events, Full free ship to poor students having 75% attendance and 60% marks who are not receiving any scholarship, Free Meal/Financial Assistance facilities to all blind students residing in the hostels, Hand Driven Tricycle provide to Physically Handicapped Students, Award to students who have set an example in the campus by their extraordinary task, Full free ship tuition fee to Single Girls Child for PG Courses, Full free ship to the dependents of Martyrs, Full free ship for five poor students VC discretionary category

Residential Facilities

Swami Vivekanand boys Hostel

Facilities: This hostel has 436 residential capacity Rooms have been allotted to the students strictly follows reservation policy. The hostel has mess facility which is presently running in cooperative mode. The hostel also has a cycle stand, reading room, common-hall, TV-Room, and sports facilities for table tennis, carom board, badminton etc. Water coolers cum filters are installed at convenient locations in the hostel.

The hostel also has a library which was established by organizing book donation camps under the program named as **"PRAYAS"**. Students, faculties and staff of the universities donate books in the hostel library to enrich it.

Events: Hostel also organizes events like hostel day and other cultural events for the holistic growth of the inmates. However, due to pandemic situation the same was not organized last year.

Ragging Free: In line with the government and university policy, the hostel has zero tolerance for ragging and it is totally free from any ragging. The

students from second year to final live together in a harmonious environment.

Dr. B. R. Ambedkar Boys Hostel

The Hostel was established in July, 2018 for the new entrant students with the capacity of 200 students, comprising one hundred rooms, one common room, a dining hall, a TV room, a reading room, 04 Water Purifiers and all necessary facilities. In the Session 2022-2023, a total of 196 students were admitted from various departments of the university. With reference to the allotment of rooms the hostel rules are strictly followed. Sports and reading facilities are also available for the students residing in the hostel.

Saheed Veer Narayan Singh Boys Hostel

The Hostel was established in July 2018 comprising of 100 rooms (Capacity-200 Students), one common room, dining hall, TV room, reading room, 40 toilets, water purifier with all necessary facilities. For fresh and clean water 04 cooler and purifier are available at different places in hostel. There are two residential quarters for hostel wardens. In the session 2022-23, a total of 192 students were admitted in which 33 UR, 27 SC, 17 ST, 89 OBC, 26 EWS, 01 PH and 03 Minority. As per as the room allotment is concerned the hostel and university rules are strictly followed.

Sports facilities like Chess, Carom, Badminton etc. are also available for the students residing in the hostel. A mess facility is available in the hostel on contract basis.

Rajmohani Devi Girls Hostel

Hostel provides mess facility to the inmates:

In this hostel total 225 rooms are available and 299 students has been allotted residential facility by strictly following the reservation.

- Hostel provides food facilities to the students on the basis of mess tender by University.
- Grievance redressal (by providing feedback register) of students.
- Hostel administration resolves issues related to the hostel mess facilities.
- Arrangement of separate food for girls who have any health related issues (Khichdi /Dalia).
- Hostel arranges feast or special food for special occasions like Independence Day, Republic Day, Navratri, Ramzan, Holi, Diwali and Women's day etc.
- Special food provided by the mess on every Saturday and Sunday.
- Mess cut facility can be availed by girls as per hostel rules.

Bilasa Devi Girls Hostel

Hostel provides mess facility to the inmates:

In this hostel total 101 rooms are available and 177 students has been allotted residential facility by strictly following the reservation

- Hostel provides food facilities to the students through mess.
- Grievance redressed (by providing feedback register) of students.
- Hostel administration resolves issues related to the hostel mess facilities.
- Arrangement of separate food for girls who have any health related issues (Khichdi /Dalia).
- Hostel arranges feast or special food for special occasions like Independence Day, Republic Day, Navratri, Ramzan, Holi, Diwali and Women's Day etc.
- Special food provided by the mess on every Saturday and Sunday.
- Mess cut facility can be availed by girls.
- Hostel has meditation and AC reading room for its inmates to maintain healthy mental condition of its students.
- Hostel has sanitary napkin destroy machine for maintaining hygiene of its residents.
- A new android LCD TV is installed for entertainment and to give updated current affairs news to its students.

Minimata Girls Hostel

Hostel provides mess facility to the inmates

In this hostel total 100 rooms are available and 178 students has been allotted residential facility by strictly following the reservation

- Hostel provides food facilities to the students through mess.
- Following mess menu has been strictly implemented in the hostel mess :
- Grievance redressal (by providing feedback register) of students.
- Hostel administration resolves issues related to the hostel mess facilities.
- Arrangement of separate food for girls who have any health related issues (Khichdi /Dalia).

- Hostel arranges feast or special food for special occasions like Independence Day, Republic Day, Navratri, Ramzan, Holi, Diwali and women's day etc.
- Special food provided by the mess on every Saturday and Sunday.
- Mess cut facility can be availed by girls.

Girls Research Hostel

There is separate girls research hostel with all modern facilities with the capacity of 32 beds.

Hostel organizes and motivates inmates to participate in various co-curricular and extra-curricular activities for their holistic development. Few are listed below:

Central Placement Cell

The Central Placement Cell (C.P.C) of Guru Ghasidas Vishwavidyalaya endeavors to facilitate and provide suitable placement in reputed multinationals, government organization, NGO's and the private sector. All students of Vishwavidyalaya are entitled to placement assistance, need based training and counseling for employment. The cell assures support to the visiting companies at every stage of the placement process by making Vishwavidyalya infrastructure available to them.

The Central Placement Cell of Guru Ghasidas Vishwavidyalaya has all required modern infrastructure facilities for receiving various companies in the campus and also for imparting training to the students. Namely it has an air-conditioned Seminar Hall which can house about 200 persons as well as air-conditioned Interview rooms and many other facilities available in the Vishwavidyalaya such as conference room and a seminar hall with a capacity of 100. The Vishwavidyalaya has a centrally air-cooled state-of-the-art modern auditorium (Rajat Jayanti Shabhagar) having all ICT facilities which can house 800 persons.

The CPC will act as an interface between the industry and the students and will primarily enable the students to select the best available for their career. It facilitates the selection process of all the companies as per their requirement. The CPC liaisons with corporate sectors and many organizations to provide suitable jobs for the candidates completing their study from the Guru Ghasidas Vishwavidyalaya. The CPC plans to conduct seminars and workshops to enable the students of Vishwavidyalaya to become successful professionals. The CPC aims to expose its students to such training which is related to latest technologies in different areas besides organizing the placement activities.

Accommodation

Jawahar Atithi Griha

The Vishwavidyalaya Guest House, located amidst lush green surrounding and pollution free environment, has 16 well-furnished and air-conditioned rooms to provide comfortable stay to visitors to the Campus at a reasonable charge and 01 air-conditioned conference hall for meetings. It serves delicious vegetarian food to the guests at reasonable charges. A well-equipped kitchen operates within the guest house premises. At present all the rooms are equipped with television with DTH system. Refrigerators have been installed in 08 rooms. Four VIP rooms have been equipped with direct dialling telephone facility.

Forestry Guest House

The Forestry Guest House was established with a grant-in-aid received from Indian Council for Forestry Research and Education (ICFRE), Dehradun. It has 31 rooms. The guest house is surrounded by different forest tree species. The guest house provides temporary accommodation to visiting teachers, research scholars and students. The guest house has well equipped modern Gymnasium. All the rooms are well furnished. Presently, the forestry guest house has been temporarily converted into a hostel to meet the increasing demand of accommodation for students.

New International Guest House

The International Guest House is constructed with a grant-in-aid from UGC XI plan. It is newly constructed building with G+ 2 floors. It has five VIP suites, 38 rooms, one party hall and Gymnasium. It is located at the elevated southern area of campus and surrounded by the lush green area.

Residential Facility for Employees

The University extends residential facility to its employees. Presently, there are 233 staff quarters for different categories of Teaching/Non-Teaching staff of the University. The staff colony is very well connected by roads with well-lit avenues. The colony is surrounded by lush green trees and has a pleasant environment. A 'Kali' temple built near the quarters provides a space for peaceful meditation and for occasional social celebrations. Residential facilities for Employees in the campus are as follows:

Auditorium and Conference Halls

Rajat Jayanti Sabhagar (Silver Jubilee Auditorium)

To commemorate Silver Jubilee Year (2007) of

the University, a centrally air-cooled auditorium with a seating capacity of about 800 persons was constructed. Apart from annual events, some other functions, such as Convocation Ceremony, Guru Ghasidas Jayanti, Central University Foundation Day and Teachers Day, Cultural programmes, seminars, discussions and lectures, etc. are also hosted in the auditorium.

Conference Hall (with Smart Class facilities)

Located in the administrative block of the university, the fully air-conditioned conference hall can accommodate up to 100 persons. The conference hall is a multipurpose venue for holding meetings, seminars, workshops, Ph.D. viva-voce and various co-curricular activities and is equipped with all the latest audio-visual facilities.

Mini Conference Hall

In addition to the main conference hall, an air-conditioned mini conference hall is located on upper floor in the administrative block of the university with a seating capacity of about 40 persons. The conference hall is a multipurpose venue for holding meetings, seminars, workshops, Ph.D. viva-voce and various co-curricular activities.

Central Library

The Central Library of the University was established on 26th October 1984 to meet the academic needs and information requirements of the students, teachers and research scholars. It is housed in a spacious building, having sitting capacity of more than 500 users. Its collection comprises of 181274 books, 11454 E-books, 4748 back volumes of Indian/ Foreign scholarly journals and 1947 PhD theses (1704 hard copy, 243 soft copy). Library uses SOUL2.0 Library Management Software (LMS) for its in-house operations and the software is integrated with and RFID surveillance system. To access E-resources of the library, 50 personal computers available in the Internet Lab of the Library with free Internet and Wi-Fi facilities along with this, the library also provides Reprography, Current awareness services (CAS) and selective dissemination of information (SDI) services. Orientation programs for the users are also organized to make them aware of the services of the library.

Services and Facilities

- Book Lending services
- Inter-Library Loan
- Reprographic Services
- Reference Services
- Internet
- OPAC / Web OPAC
- Wi-Fi (within the campus area)
- Smart class room and semi-smart class room for orientation of services and resources
- RFID based / Surveillance System
- CAS and SDI (On demand)

Cafeteria

New Cafeteria Building with G+1 floor is constructed with grant-in-aid from UGC XI plan. It is situated behind university auditorium. It has one big cafe-seating hall of 25m x 16m at ground floor. There are five big halls on the first floor; the total built up area of the cafeteria is 1005 sq.m. The cafeteria is successfully catering to the daily needs of the university community. The cafeteria remains open on all working days from 8.00 a.m. to 7.00 p.m. On special occasions, the cafeteria opens on holidays too.

Health Centre

Health Centre is located in the Centre of the University Campus. Health Centre has Male Ward, Female Ward and a Pathological lab caters to the need of the student, residences of the campus and employees of the University. One Medical Officer along with assisting staff compounder, ANM (Female) and Ambulance driver is posted at the centre. From time-to-time specialist doctor visits the health Centre. At the same time patient required further treatment is referred to Medical College (CIMS) or Apollo Hospital. All the medical facilities, treatment and medicines for students, employees are provided free of cost. The health Centre has an Electro Cardio Grapy (ECG) Machine and a Chemical Blood Analyzer for carrying out various blood tests. The health Centre also provides twenty four hours ambulances services and doctors on call are available round the clock. The Centre has also limited in-patient facility.

Internal Quality Assurance Cell (Iqac)

To monitor and improve the day-to-day functioning of various groups of the University, Internal Quality Assurance Cell has been established which has been strengthened during this period. The cell is expected to examine, suggest and monitor the effective implementation of various initiatives towards improving the functioning of the University. The Internal Quality Assurance Cell of the University is committed to improve upon the overall teaching-learning processes, research eco-system and academic ambiance for providing quality higher education.

Scheduled Caste (Sc)/Scheduled Tribe (St) Cell

The University established a SC/ST cell as per the UGC guidelines in November 1988. The Cell provides assistance to the SC/ST students to receive scholarships as per the government rules and deals with their problems regarding this. The Cell also observes the reservation policy pursued by the academic departments with regard to admissions. The main objectives of the cell are:

- To assist the SC/ST, OBC, Minorities and Physically challenged students from Chhattisgarh as well as outside C.G. states in getting scholarships.
- To document the details of the SC/ST, OBC, Minorities and Physically challenged students.
- To help the students through counseling.
- To liaison with the government officers at the district and state level in Chhattisgarh and outside C.G. regarding various scholarships.

Sports Facilities

The Physical Education and Sports department of the University provides and maintains the sports facilities in the campus. The existing sports facilities include, two floodlit basketball courts, Volley Ball courts, Cricket, Tennis, Flood-light, four Kho-Kho, Badminton courts, Kabaddi courts, Modern Gym, Table-Tennis Hall, Hand-ball ground, Football ground, and Badminton courts in Girls' and Boys' Hostels. These facilities are used by the students, teachers and employees of the campus for their regular sports activities and also for organizing special sports events and competitions at various levels. Training by specialized coaches are provided to the students.

Internal Complaint Committee (ICC)

Vishwavidyalaya has adopted University Grant Commission Regulation, 2015 for Redressal, Prevention/ Prohibition of sexual harassment of the women employees and students in Higher Educational Institutions. The regulation explains about the prevention measures and responsibilities. The nature of the regulation is legal and hence, it is mandatory for Universities/Colleges. In compliance to the above regulation of UGC, Guru Ghasidas Vishwavidyalaya has constituted an Internal Complaint Committee. This committee is empowered to enquire about the complaint received with regard to the sexual harassment in the University Campus.

Title, Application, and Commencement-

- These regulations may be called the University Grants Commission (Prevention, prohibition, and redressal of sexual harassment of women employees and students in higher educational institutions) Regulations, 2015.
- They shall apply to all higher educational institutions in India.

They shall come into force on the date of their publication in the Official Gazette

Skill Development Cell

Dr Rohit Raja, Nodal Officer of the Skill Development Cell has motivated the students of different departments of university was informed about the Pradhan Mantri Kaushal Vikas Yojana and skill India mission of Government of India, from time to time. The Ministry of Skill Development & Entrepreneurship (MSDE), Govt. of India, is implementing the flagship skill development scheme of Government of India - Pradhan Mantri Kaushal Vikas Yojana 4.0 (PMKVY 4.0). With the roll-out of the National Education Policy (NEP) in 2020, there has been a renewed focus on vocational skill training imparted by schools and higher education institutes, thus, integrating mainstream academics with practical vocational skill training.

NSDC had circulated an online form to aggregate demand, and the university has expressed interest to participate in PMKVY 4.0. Accordingly, Guru Ghasidas Vishwavidyalaya has been allocated 2310 targets for implementing training under PMKVY4.0.

National Cadet Core

The National Cadet Corps (NCC) is a youth organization that operates in India, with the primary objective of developing character, discipline, and a sense of nationalism among young cadets. It was established in 1948 under the Ministry of Defence, Government of India.

The NCC offers basic military training to school and college students, with an emphasis on community service, leadership, and adventure activities. The organization aims to create responsible and patriotic citizens who are committed to serving the nation.

The NCC has three branches: the Army, Navy, and Air Force, and is open to both boys and girls. Cadets are enrolled in the organization through their schools or colleges and participated in a range of

activities, including drills, weapons training, sports, social service, and adventure activities like trekking, camping, and mountaineering.

The NCC has been instrumental in producing many leaders and achievers in various fields, including the armed forces, politics, and sports. It is considered one of the largest youth organizations in the world, with over 13 lakh cadets enrolled across the country.

Guru Ghasidas Vishwavidyalaya, Bilaspur, CG is one of the premier institutions in India that offers NCC classes to its students.

National Service Scheme

The National Service Scheme (NSS), funded and governed by the Indian Government's Ministry of Youth Affairs & Sports, provides students with an opportunity for government-sponsored community service. Its main goal is to offer practical experience to students in actively contributing to community service. Since its introduction in Guru Ghasidas Vishwavidyalaya in 2016, the NSS has expanded to 21 units with 35 Program Officers and 2000 registered student volunteers. These units encompass various fields of study, including Botany, Engineering, Physics, Forestry, Social Sciences, Law, and more.

The NSS units have effectively conducted community development programs, webinars, awareness campaigns, and national festival celebrations. The enthusiastic participation of dedicated volunteers and Program Officers embodies the NSS motto - 'NOT ME BUT YOU.' The NSS has played a pivotal role in fostering personal development and social responsibility among students, promoting a spirit of service towards the community's welfare.

Under the dynamic leadership of Vice Chancellor Prof. Alok Kumar Chakrawal, the NSS has witnessed remarkable progress and community impact. Their commitment to students' overall development and social service has led to the establishment of new units, uniting more volunteers and instilling a sense of unity and purpose within the NSS. Their support in organizing camps, awareness drives, and donation campaigns has significantly benefitted the less fortunate.

Central University (CU) Integrated Portal

As per directives of the University Grants Commission (UGC), GGV has appointed a Nodal Officer to dealt with the CU Integrated Portal for focussed Planning, Financing, Administration and Coordinated development of Central Universities launched by the UGC with an aim towards paper less transactions between CUs, UGC & MHRD. UGC has provided user ID and password to the Nodal Officer to fill up various prescribed forms provided by UGC for teaching/non-teaching staff, student strength and expenditure details etc.

Presently, the CU-Integrated portal launched in its new format and the Dash Board having two main sections.

First section is about the profile of the University for filling of basic details of the University and second section is about the monthly and yearly forms related to the day to day activities of the University.

Total forms in New CU Portal are 21 and out of 21 forms, 12 forms have to be filled and updated on monthly basis whereas rest of the 09 forms are updated and filled on yearly basis.

The CU Portal remains open from 1st – 5 to 15 th of every month.

The Nodal Officer with the help of all concern sections get filled all the prescribed forms on the monthly basis provided by UGC in the CU Portal within stipulated time.

This facilitates us as well as MHRD & UGC to know status and record updating.

Choice Based Credit System

CBCS mission is to advance knowledge through interdisciplinary teaching, research, and service that improves the capacity of individuals, families, and diverse communities to promote productive, satisfying, healthy, and safe lives across the lifespan.

We started full flagged CBCS from year 2018-19, adopting and implementing all guidelines of the UGC, AICTE and NCTE.

The University has fully implemented the Choice Based Credit System (CBCS) for the undergraduate programmes from the session 2018-19. Skill Enhancement Courses in B.Sc. (Hons.) /B.A. (Hons.)/ BE / B. Pharm / B.Ed and B.P.Ed Programme were included where these value-based and/or skill-based courses are aimed to provide hands-on-training, competencies, skills, etc.

In 2021, we have shifted our entire curriculum to LOCF based guidelines. We introduced new ability Enhancement Courses and Skill enhancement courses from academic session 2021 -22 onwards, along with few Values added courses as optional in accordance with NEP 2020 guidelines in 2022-23. ❑

Nurturing Science Education and Research in *Swaraj Bharat*

Prabha Shankar Shukla*

Robust agricultural infrastructure and community empowerment through skill development efforts are the major focus of Swaraj India's comprehensive rural development approach. The foundation of this strategy is investments in research facilities, labs, and agricultural extension services, which promote agricultural innovation and knowledge sharing. Through extension services, these facilities close the knowledge gap between theory and practice while advancing scientific research. Most importantly, Swaraj India prioritises skill development, turning citizens into knowledgeable technicians and entrepreneurs. Programmes for technical competency educate people on how to operate agricultural machinery. At the same time, management techniques are provided, producing powerful leaders and entrepreneurs in rural areas. Communities that are resilient and self-sufficient are built by this complex empowerment. Local experts maintain the infrastructure, and empowered leaders drive economic growth and communal activities. The philosophy of Swaraj India fosters community pride, responsibility, and ownership. This commitment ensures careful maintenance of the infrastructure, assuring future generations have greater opportunities. By integrating skill development and infrastructure development, Swaraj India enhances the quality of life in rural areas and offers a model for sustainable development. Together, communities create a future in which rural India prospers on all fronts—economic, social, and cultural. The goal of Swaraj India paves the way for an independent, robust, and dynamic rural India.

In India, the historical and philosophical idea of Swaraj is essentially about self-governance and self-sufficiency. In agricultural science, the term "Swaraj" refers to a comprehensive strategy for agricultural research and education that gives farmers the tools they need to improve sustainability and guarantee food security. Agriculture science education and research are essential to accomplishing these objectives and advancing the country.

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Agricultural Education in *Swaraj Bharat*

Empowering Farmers

In alignment with the principles of Swaraj, agricultural education places significant emphasis on imparting science-based knowledge and skills to farmers in India. Educational institutions and universities throughout the country offer specialized courses in agriculture, encompassing subjects like crop science, soil management, pest control, and sustainable farming practices. These educational programs are designed to enhance farmers' understanding of traditional farming methods while incorporating modern scientific techniques. Agricultural education in *Swaraj* India, embodies the spirit of self-governance and self-reliance. In accordance with Swaraj principles, India has made substantial progress in equipping its farmers with comprehensive and specialized agricultural education. Certain institutions and universities have developed distinctive programs and courses aimed at enabling farmers to comprehend both scientific knowledge and their traditional farming practices, all while harnessing the potential of new agricultural technologies.

Diverse Curriculum

Agricultural education in Swaraj India, offers a diverse and multifaceted curriculum. Students enrolled in these courses delve into various aspects of agriculture, including crop science, soil management, pest control, agroecology, and sustainable farming practices. When developing the curriculum, every effort is made to ensure that all students gain a comprehensive understanding of different facets of the agricultural ecosystem, encompassing both theoretical knowledge and hands-on practical experiences.

In Swaraj India, agricultural education transcends traditional boundaries, offering a comprehensive and multifaceted curriculum that immerses students in the intricate world of agriculture. This forward-thinking approach equips students with theoretical knowledge and cultivates their

practical skills, fostering a profound comprehension of the agricultural ecosystem. At the core of this curriculum lies a diverse array of subjects. Students delve into crop science, gaining insights into the intricate genetic complexities, growth patterns, and distinctive characteristics of various crops. This foundational knowledge serves as a stepping stone for more specialized studies, enabling students to comprehend the intricacies of sustainable farming practices, soil management, and pest control. Soil management, a fundamental pillar of agriculture, is accorded paramount importance. Students learn about soil composition, fertility enhancement, and erosion prevention techniques. They are introduced to sustainable practices like crop rotation and organic soil enrichment, ensuring a thorough grasp of methods that preserve soil health and fertility without depleting its natural resources. Pest control strategies form another significant aspect of the curriculum. Integrated pest management techniques are taught in-depth, encompassing biological, physical, chemical, and cultural methods. Additionally, students explore agroecology, understanding the intricate relationships between organisms within agricultural systems. This knowledge empowers them to develop farming practices that are ecologically sustainable and harmonious with the environment.

One of the distinctive features of Swaraj India's agricultural education is its emphasis on experiential learning. Students actively engage in farm activities, applying the knowledge they have acquired in the classroom to address real-world scenarios. Working alongside farmers and experts, they gain practical insights into planting, harvesting, and post-harvest management. This hands-on involvement enhances their practical skills and fosters a deep appreciation for the intricate complexities and challenges faced by farmers. Furthermore, the curriculum adopts an interdisciplinary approach, encouraging students to explore connections between agriculture and related fields, such as environmental science and economics. This comprehensive perspective broadens their understanding, equipping them to tackle agricultural challenges from various angles and facilitating the development of innovative solutions. At its core, Swaraj India's agricultural education system serves as a guiding beacon for progressive learning. By providing a curriculum that combines theoretical depth with practical application, Swaraj India prepares its students not only as skilled farmers but also as visionary leaders capable of driving agricultural sustainability. Equipped with a diverse skill set and a profound respect for the environment, graduates of Swaraj India's agricultural programs are well-prepared to address the evolving challenges of the agricultural sector and make significant contributions to sustainable farming practices in the nation.

Preservation and Integration of Traditional Wisdom with Modern Techniques

One of the distinguishing characteristics of agricultural education in Swaraj India is its emphasis on preserving and integrating traditional agricultural wisdom with modern scientific techniques. Students are encouraged to appreciate the wisdom passed down through generations while being exposed to the latest innovations and advancements in agricultural research. This fusion of traditional knowledge and modern techniques creates a comprehensive approach to farming, empowering farmers to make well-informed decisions that balance heritage with innovation. In the realm of agricultural education in Swaraj India, a unique combination occurs, striking a delicate equilibrium between the time-honored wisdom of the past and the cutting-edge advancements of the present. This distinctive feature lies at the heart of Swaraj India's agricultural education framework, where students are instructed in the scientific intricacies of modern farming and motivated to delve into the profound reservoir of traditional agricultural wisdom passed down through generations. Essential to this approach is the recognition that conventional wisdom, accumulated over centuries, offers invaluable insights into sustainable farming practices. Students are encouraged to value the deep-rooted knowledge that has sustained communities for generations. From ancient planting techniques synchronized with lunar cycles to indigenous pest control methods, these traditional practices are interwoven into the curriculum. By understanding these practices, students gain a profound respect for the harmony between nature and farming that has been intrinsic to traditional agriculture.

However, this reverence for tradition does not imply resistance to progress. Agricultural education in Swaraj India, focuses on educating the youth about the latest innovations and findings in agricultural studies. These include recent applications such

as genetic engineering, precision agriculture, and biotechnology. Such exposure provides new insights, allowing the integration of traditional wisdom with the precision of the latest technology. As a result, this blending of ancient and contemporary techniques forms a holistic approach to farming. While teaching students about traditional agricultural practices, they also recognize that in the 21st century, modern approaches are essential for improving efficiency, productivity, and sustainability. For example, combining age-old organic farming practices with modern innovations like vertical farming or hydroponics enables farmers to optimize land use, conserve water, and cultivate crops throughout the year. This combination allows farmers to make informed choices incorporating traditional and modern techniques. Farmers are equipped with ancestral wisdom as well as contemporary scientific knowledge, enabling them to adapt to changing weather conditions, manage pests and diseases effectively, and meet consumer demands. In doing so, they become the custodians of their land and their invaluable cultural heritage, simultaneously preserving their ancestors' knowledge while embracing progress.

Swaraj India's educational ideology aims to raise a new generation of farmers who are not limited by the constraints of tradition nor blinded by the allure of modernity. Instead, they become informed stewards of the land who respect ancient farming wisdom and harness the benefits of modern farming technologies. This comprehensive education equips them to sustain their livelihoods and make meaningful contributions to the agricultural landscape, ensuring a harmonious coexistence between tradition and progress in the ever-evolving field of agriculture.

Practical Learning, Eco-Friendly Farming, and Field Exposure

Educational programs place a strong emphasis on practical learning and field exposure. Aspiring farmers actively participate in hands-on activities, such as soil testing, crop cultivation, and pest management. Students acquire practical knowledge and skills through field trips to agricultural research centers, organic farms, and agribusiness enterprises, which enhances their problem-solving abilities and prepares them to address the challenges faced by farmers in their communities. Swaraj India's agricultural education strongly emphasises environmentally friendly forms of agriculture. Agroecology is presented to students as a science that applies ecological principles to farming. This holistic management approach helps students learn how to maintain the ecosystem and promotes a collaborative relationship between humans and nature. They are educated on integrated pest management methods, crop rotations, and companion planting, all of which contribute to a cleaner and more sustainable agricultural environment with reduced reliance on toxic synthetic chemical pesticides.

Promotion of Organic Farming

Agricultural educational institutions advocate for organic farming techniques, including practices such as crop rotation, the application of manure or compost, and the use of biological methods for pest control. Organic farming is presented to students as a method that enriches the soil, has a minimal environmental impact, and produces chemical-free crops with positive implications for humanity. This wisdom aligns with Swaraj's principles, which encourage farmers to adopt more natural and environmentally friendly practices. In pursuit of building a self-sufficient India rooted in traditional ways of life and environmental consciousness, Swaraj India strongly emphasises organic farming. Together with agricultural educational institutions, it serves as the foundation for promoting a culture of organic farming and transforming the Indian agricultural landscape. Swaraj India advocates for comprehensive approaches to organic farming based on natural pest control, composting, and crop rotation, to revolutionize farming practices and foster a harmonious relationship between humans and nature.

Agricultural education, the cornerstone of Swaraj India, forms the foundation of this initiative. Swaraj India acknowledges and recognizes that education is a powerful catalyst for transformation. Under Swaraj India, the role played by these agricultural educational institutions in disseminating knowledge on various aspects of organic farming is significant and crucial. Students are introduced to the intricacies of natural pest management, which involves the use of beneficial insects, biocontrol agents, and plant extracts as alternatives to potentially harmful chemical pesticides for crop protection. They also learn how to convert organic waste into

valuable compost, which enhances soil fertility. Furthermore, students receive comprehensive training in crop rotation, a fundamental practice in organic farming. This teaches students to appreciate the importance and necessity of crop diversity in preventing soil depletion and promoting increased production. Organic agriculture is promoted through a multidimensional education curriculum. Soil fertility improvement is highlighted as a crucial aspect of organic farming. In contrast to traditional farming practices that deplete the land of vital nutrients, natural farming techniques enhance soil fertility for long-lasting productivity. With this knowledge, farmers can employ environmentally friendly methods that foster a deep respect for the land they cultivate. The curriculum also underscores the reduced health risks associated with organic farming compared to inorganic methods. Conventional farming practices relying on chemical inputs can lead to environmental degradation, including soil erosion, water pollution, and biodiversity loss. In contrast, organic farming strives to minimize these negative impacts by emphasizing natural inputs and environmentally friendly production approaches. Organic farming promotes a harmonious relationship between farmers and nature, ensuring that future generations can enjoy a healthier environment.

The central focus of the Swaraj India initiative is the production of healthier, chemical-free crops. By adopting natural/organic farming methods, the reliance on synthetic pesticides and fertilizers can be eliminated. As a result of organic farming, the produce is free from harmful residues, resulting in the cultivation of safe, nutritious, and healthier food. This emphasis on health strongly resonates with consumers, driving the demand for organic products and creating a market for sustainable agriculture. Agricultural educational institutions guide farmers in transitioning to organic farming through the use of techniques, practices, and tools often referred to in this context. With knowledge of natural pest control, composting, and crop rotation, farmers are confident in their ability to shift from conventional farming systems. Swaraj India supports this transition by providing farmers with the necessary equipment, technical assistance, and access to organic seeds. Additionally, the organization collaborates with farmers, offering workshops, training, and educational campaigns to dispel myths and misinformation about organic production.

Farm Management and Marketing Strategies

Farm management is at the heart of Swaraj India's agricultural education. While conventional agricultural education typically focuses solely on cultivation methods, Swaraj India recognizes that a comprehensive understanding of farm economics is essential. This allows students to grapple with various aspects related to the judicious use of resources, planning, budgeting, risk management, resource allocation, and problem-solving. These skills empower future farmers to grasp the principles of resource allocation, production optimization, and waste reduction in modern agriculture. Farm management training within Swaraj India also promotes a sustainable approach, involving students in learning about issues related to sustainable agriculture, water resource conservation, healthy soil management, and more. They gain a holistic understanding of establishing eco-friendly farms, aligning with Swaraj India's commitment to a green vision.

One of the significant challenges faced by farmers is the issue of connecting with markets and reaching customers. Swaraj India addresses this challenge by providing specialized marketing strategy courses for the agricultural sector. These courses encompass teaching students about market analysis, consumer behaviour, branding, and digital marketing strategies. Such knowledge equips them with insights into their consumers' needs, enabling them to identify market opportunities and design appropriate marketing campaigns. Swaraj India also emphasizes the importance of technology in modern agriculture, including online and e-marketing. It educates students on internet marketplaces, social media marketing, and e-commerce platforms to help them leverage technology to access markets. By bridging the gap between producers and consumers, farmers can establish direct relationships with buyers, ensuring fair prices for their produce and reducing dependence on intermediaries.

Value addition is a fundamental pillar of agribusiness success. Swaraj India's agricultural education curriculum includes modules on value-addition techniques, such as food processing, preservation, and packaging. Students are introduced to methods for transforming raw agricultural products into processed goods with higher market value. By adding value to their produce, farmers can diversify

their income streams and increase their profitability. Additionally, Swaraj India fosters creativity and innovation in value addition. It encourages students to generate new product ideas, experiment with various recipes, and create unique agro-products. This spirit of innovation makes it economically viable and turns farmers into pioneers, introducing new products to the market.

Successful and sustainable agribusiness ventures rely on an understanding of the economic dynamics of agriculture. Agricultural education provided by Swaraj India includes subjects like agricultural economics, covering cost analysis, price determination, market trends, and financial management. The study of factors leading to fluctuations in agricultural prices, demand-supply dynamics, and global market behaviour constitutes the core of this course. Furthermore, students learn about government policies, subsidies, and other forms of support in the agricultural industry. With this knowledge, they can make informed decisions, explore financing options, and utilize available state schemes to support their agribusiness enterprises. This understanding enables farmers to maximize their profits and advocate for policies that benefit the agricultural economy.

Empowering Farmers and Communities through Entrepreneurship Education

The integration of entrepreneurship and agribusiness skills into agricultural education in Swaraj India, has a profound impact on farmers and rural communities. Swaraj India empowers its farmers to become more self-reliant and economically independent by providing them with knowledge on farm management as a business. Farmers evolve into more than just cultivators; they become decision-makers in the market and adopt modern farming practices. Additionally, the infusion of entrepreneurial spirit into the agricultural community creates a ripple effect in other rural economies. This ensures that farmers are not only involved in traditional farming but also engage in value addition and innovative product development, thereby creating employment opportunities within their communities. It opens doors for local artisans, processors, and retailers who find markets for their products, ultimately promoting rural industries. This stimulation of agriculture contributes to economic growth in rural areas, reduces migration to urban centers, and preserves the agricultural way of life.

The introduction of entrepreneurship and agribusiness into agricultural educational programs represents an innovative departure from the traditional model of subsistence farming. Agripreneurship in Swaraj India signifies not only enriching individuals financially but also rebuilding villages into self-sustaining and autonomous communities. In pursuit of this vision, Swaraj India nurtures a generation of technologically savvy, market-oriented, and innovation-driven agribusiness entrepreneurs. In doing so, it paves the way for an economically independent Indian agriculture industry that embodies the principles of Swaraj.

Community Engagement and Knowledge Sharing

Agricultural education institutions actively engage with local communities. Students and faculty collaborate with farmers, conducting workshops, awareness programs, and knowledge-sharing sessions. These interactions facilitate the exchange of traditional wisdom and scientific knowledge, fostering a sense of community and cooperation. Farmers are encouraged to share their experiences, challenges, and solutions, creating a supportive network that strengthens the agricultural community in the spirit of Swaraj. In Swaraj India, agricultural education promotes self-education and continuous adaptation. Students are encouraged to regularly study current research to stay updated on developments in agricultural technology, given the dynamic nature of agriculture and the challenges posed by climate change. Farmers also receive lifelong education on enhancing their skills, including adjusting their farming practices in response to changing agricultural conditions. Empowering farmers through agricultural education in Swaraj India, involves a multifaceted approach that combines traditional wisdom, modern techniques, practical learning, entrepreneurship skills, community engagement, and continuous learning. By nurturing a group of educated, skilled, and innovative farmers, India can advance its productive agriculture, achieving self-sufficiency, environmental sustainability, and community well-being in the spirit of Swaraj.

Promoting Sustainable Practices

Sustainability and self-sufficiency lie at the core of Swaraj's principles. Agricultural education in Swaraj India, encourages sustainable farming practices, such as ecological farming and organic production, as well as the conservation of natural

resources. Students are educated on the significance of biodiversity, the preservation of indigenous crops, and the reduction of chemical usage. This knowledge is essential for assisting farmers while also protecting the environment. Swaraj India is founded on the principles of sustainability and self-reliance, ushering in a new era in agricultural education. This era is characterized by output-oriented crop intensification and sustainable agriculture in harmony with nature, including organic farming. Eco-friendly farming, organic agriculture, and responsible use of natural resources are all exemplified by agricultural education in Swaraj India. This approach instills these values into the hearts of aspiring farmers and benefits not only individual growers but also the environment.

Responsible Use of Natural Resources

The responsible use of natural resources is a fundamental pillar of sustainable agriculture in the Swaraj India philosophy. Students learn about water conservation methods such as rainwater harvesting and drip irrigation, which maximize water utilization while reducing the effects of water scarcity. Agricultural education also focuses on the need for soil conservation methods like contour ploughing and cover crops to mitigate erosive processes that could otherwise lead to soil loss. Farmers play a vital role in conserving their agricultural land through appropriate irrigation practices and the judicious use of naturally available water and soil components.

Preserving Biodiversity and Indigenous Crops

In the Swaraj India model, agricultural education considers biodiversity and native crops as essential elements and places significant emphasis on them. Agricultural ecosystems and students learn about plant and animal species that form these ecosystems. Indigenous crop varieties are well adapted to the local climate and exhibit unique traits such as drought resistance and pest tolerance. People are educated on the importance of conserving these types of crops. The practice of fostering and protecting these crops contributes to biodiversity preservation and ensures food availability in the event of climate change.

Reduction of Chemical Inputs

In its agricultural education, Swaraj India strongly supports the reduction of chemical inputs. Students learn about the negative impacts of the overuse of pesticides and fertilizers on soil health, water quality, and human well-being. Chemical inputs are reduced by encouraging farmers to receive education on adopting more sustainable alternatives. The integrated farming system promotes an interdependent model that lessens reliance on external inputs by fostering collaboration between livestock and crops.

Community-based Conservation Efforts

Agricultural education in Swaraj India, extends beyond the classroom. Conservation efforts are carried out by both students and the local communities they represent. Organizing tree-planting drives, community gardens, and awareness campaigns instil a sense of environmental stewardship. These initiatives contribute to local biodiversity conservation and bring communities together to ensure environmental well-being. Swaraj India's approach to agriculturally oriented education is rooted in understanding and appreciating the knowledge held by community members and indigenous peoples. The curriculum incorporates traditional ecological knowledge passed down through generations. This wisdom from indigenous groups serves as a valuable resource, teaching students about environmentally sustainable farming approaches that have been successful and practiced for generations. In Swaraj India, agricultural education combines scientific knowledge with traditional wisdom to create a comprehensive view of environmentally friendly farming practices.

Finally, improving agricultural practices is more than just education; it is a revolution for the future of farming. Swaraj India ensures a secure future by nurturing a new generation of environmentally conscious farmers. Swaraj India's agricultural education system represents an ideal society in which people coexist with nature by integrating scientific knowledge, local wisdom, and respect for the environment, leading to the realization of sustainable and self-sufficient agriculture.

Agricultural Research in *Swaraj Bharat*

Fostering Innovation for Sustainable Farming

At the heart of Swaraj India's agricultural landscape lies a robust and dynamic research framework where innovation is not only encouraged but celebrated. India's commitment to self-governance extends into the realm of agricultural

research, where cutting-edge initiatives are pursued to address the challenges faced by farmers. This dedication to innovation is a cornerstone of Swaraj India's approach, to ensure food security, enhance agricultural productivity, and promote sustainability in the face of climate change and other adversities.

Innovative and Collaborative Research Initiatives

Swaraj India advocates for research-oriented innovations to assist farmers in overcoming their challenges. Farmers and local communities collaborate with research institutions to develop new crop varieties that resist climate change stresses, diseases, and pests. Researchers conduct trials on various farming practices, irrigation models, and post-harvest management to achieve higher yields of superior-quality crops. Swaraj India's agricultural research initiatives thrive on collaboration. Research institutions, agricultural scientists, and farmers form collaborative partnerships, pooling their knowledge and expertise. This collaborative spirit extends to local communities, ensuring that research projects are grounded in the realities of farmers' lives. By working closely with the end-users of agricultural technologies, researchers gain valuable insights, ensuring that innovations are scientifically sound, practical, and applicable in real-world farming scenarios.

Developing Resilient Crop Varieties

In different regions, agriculture faces significant challenges due to changing climate conditions that lead to the emergence of new diseases and pests affecting crop yields. In response, Swaraj India's research institutions focus on developing crop varieties resilient to these challenges. Through meticulous breeding programs and genetic engineering techniques, scientists create crops that can withstand droughts, resist diseases, and thrive in diverse soil conditions. These resilient varieties maintain stable yields, providing a much-needed lifeline to farmers despite unfavourable environmental conditions.

Improving Agricultural Techniques

Agricultural research in Swaraj India, delves deeply into the core farming techniques. Scientists conduct experiments to optimize agricultural practices, exploring aspects such as planting density, crop rotation patterns, and intercropping methods. These experiments yield valuable data, guiding farmers on the most efficient and sustainable ways to cultivate their crops. By fine-tuning these techniques, agricultural productivity is enhanced, leading to increased yields and reduced wastage.

Revolutionizing Irrigation Methods

The agriculture research of Swaraj India ensures maximum water utilization as one of its most valued resources. Scientists have created innovative irrigation systems that maximize the use of every drop of water through methods like drip irrigation and rainwater harvesting systems, among others. These techniques also play a crucial role in water conservation by regulating moisture levels in plants, resulting in healthy growth and higher yields. Farmers can adapt irrigation procedures to address water scarcity in areas with limited water resources.

Enhancing Post-harvest Management

The journey of a crop does not conclude with harvesting but requires effective post-harvest management to minimize losses and ensure food security. Swaraj India's research focuses on modern storage technology, including cold storage, transportation systems, and processing methodologies. These innovations help reduce post-harvest losses and enable farmers to store their products for extended periods. Additionally, value-addition processes, such as food processing and preservation, open new marketing avenues and increase farmers' income.

Promoting Sustainable Livestock Farming

Swaraj India's agricultural research extends beyond crops to encompass livestock farming. Scientists delve into animal husbandry practices, emphasizing sustainable approaches to livestock rearing. Research projects explore efficient feed formulations, disease prevention strategies, and eco-friendly waste management systems. By promoting sustainable livestock farming, Swaraj India ensures the well-being of farmers who rely on animal husbandry while also mitigating the environmental impact associated with livestock farming.

Technology Integration in Agriculture

In agricultural research, it is important to note that Swaraj India embraces modern technologies such as AI, remote sensing, machine learning, and big data. Various techniques are employed to collect extensive information on soil health, rainfall distribution, and

yield performance. Scientists analyze this data to make data-driven decisions, enabling precise and targeted interventions in agriculture. The use of predictive models driven by AI empowers farmers with timely alerts and guidance on best practices for successful crop yields. Essentially, agricultural research represents the guiding light for the farmers of the country. It contributes to the development of resilient crop varieties, improved cultivation methods, optimized irrigation systems, advanced post-harvest procedures, enhanced animal husbandry, and the integration of intelligent technology. This aligns with Swaraj India's vision, where farming is not just a means of survival but the cornerstone of self-sufficiency, achieving nutritional and economic stability while promoting an ecologically friendly system for future generations.

It is essential to note that technology plays a vital role in achieving self-sufficiency in agriculture. Swaraj India invests in research on technologies like precision farming, automation, and big data analytics. The incorporation of technology in farming enables farmers to make informed decisions, enhance resource management efficiency, and increase farm outputs. Furthermore, mobile applications and web portals have been developed to provide farmers with up-to-date information on weather conditions, commodity prices, and advanced farming techniques. Technology stands as the vanguard in the ever-evolving realm of agriculture, guiding the way to self-reliance and prosperity. With its foundational principles rooted in self-determination and sustainable production, Swaraj India embraces transformative technologies that revolutionize traditional farming practices. Through strategic investments and research initiatives, modern agriculture is ushered into the digital era, empowering farmers with vast knowledge and capabilities while significantly increasing efficiency.

Precision Farming

Precision farming represents a revolutionary approach where agricultural practices are finely tuned and optimized at a granular level. Swaraj India conducts research on precision agriculture, employing GPS-guided tractors, drones, and sensor networks. Farmers can now meticulously monitor their fields, making precise adjustments in irrigation, fertilization, and pest management to specific zones within a field. Precision farming enhances efficiency by optimizing resource inputs and reducing wastage, making agriculture more environmentally friendly.

Agricultural Automation

Automation lies at the core of Swaraj India's agricultural transformation. Farm machinery, equipped with automation technology, executes tasks with unparalleled precision and efficiency. Automated seeding, harvesting, and sorting processes streamline agricultural operations, significantly reducing labour requirements. Swaraj India invests in research to develop affordable and user-friendly automation solutions, making advanced agricultural machinery accessible to farmers of all scales. Farmers can redirect their focus toward strategic decision-making and sustainable farming practices by automating repetitive tasks.

Data Analytics and Decision Support Systems

Swaraj India harnesses the power of data analytics to extract valuable insights from vast amounts of agricultural data. Research initiatives concentrate on developing sophisticated algorithms and decision support systems capable of analyzing data related to soil health, weather patterns, crop performance, and market trends. Through data interpretation, farmers gain actionable insights that enable them to make well-informed decisions. Predictive analytics assist farmers in anticipating challenges, optimizing planting schedules, and implementing adaptive strategies, ultimately resulting in higher yields and financial stability.

Mobile Apps and Online Platforms

Swaraj India's dedication to technology is exemplified by the development of user-friendly mobile applications and websites. These digital tools have become invaluable resources, providing instant information to farmers. Mobile-based apps offer advanced weather forecasts, pest alerts, and crop-specific recommendations, enabling farmers to respond promptly to changing conditions. Online platforms establish a direct link between farmers and markets, facilitating market-based transactions without the involvement of middlemen. These platforms also offer virtual agricultural extension services to provide farming tips and pest control information, promote sustainable farming practices, and foster continuous learning among farmers.

Remote Sensing and Satellite Technology

Swaraj India leverages remote sensing and satellite-based monitoring to track large agricultural farms. Advanced sensor-equipped satellites generate images and data to assess crop conditions, soil moisture levels, and pest infestation. Real-time monitoring enables proactive measures, including targeted irrigation and pesticide applications. Remote sensing also aids in identifying regions susceptible to droughts and other natural hazards, facilitating prompt preparation and emergency management.

Blockchain Technology for Transparent Supply Chains

Transparency and traceability within the agricultural supply chain are of paramount importance. Swaraj India explores blockchain technology to create transparent and tamper-proof digital ledgers. These ledgers document every stage of the agricultural journey, from seed to market. Farmers, consumers, and stakeholders can trace the origin of products, ensuring quality and authenticity. Transparent supply chains foster consumer trust and empower farmers by providing equitable market access and eliminating counterfeit products from circulation.

Smart Irrigation Systems and Water Management

Water, a precious resource, is managed judiciously through smart irrigation systems. Swaraj India invests in research to develop smart irrigation systems that respond to environmental changes. These systems integrate soil moisture sensors, weather forecasts, and crop water requirements to optimize water use. Other water management practices include rainwater harvesting systems, enabling farmers to collect and store rainwater for agricultural use, thereby mitigating water scarcity. Technological integration introduces a new dimension to Swarajya's agricultural landscape, empowering farmers with efficient and sustainable practices. Through precision farming, automation, data analytics, mobile applications, remote sensing, blockchain technology, and smart irrigation systems, Swaraj India equips its farmers with the relevant skills to thrive in an ever-changing world. Technological advancements contribute to Swaraj India's self-sufficiency in agriculture, creating a knowledgeable, resilient, and prosperous farming community that ensures a stable and fruitful future for the country's agricultural sector.

Challenges and Solutions

Infrastructure Development

Swaraj India recognizes the crucial role of robust infrastructure in rural villages. The urban-rural technological disparity is evident, with rural areas having limited access to digital resources and information, impeding their ability to embrace advanced agricultural practices. Introducing digital platforms and mobile applications tailored for rural farmers helps bridge this technological divide. These platforms provide real-time information on weather patterns, crop management techniques, and market prices, empowering farmers with valuable data. Investments in information and dissemination centers offer farmers the latest research outcomes and technologies. Swaraj India is unwavering in its commitment to rural community development, which includes building a strong foundation in rural areas. The understanding that a robust agricultural base is pivotal for national growth drives the movement to allocate significant resources to the development of research centers, labs, and agricultural extension services. These strategic investments act as catalysts for growth by facilitating information sharing and equipping smallholder farmers with up-to-date knowledge and innovative practices. Policies support the establishment of cold storage facilities in rural areas, reducing post-harvest losses and encouraging the cultivation of perishable, high-value organic crops. Improved transportation networks ensure that organic produce can be swiftly transported to markets, preventing spoilage and maintaining product quality. However, setting up infrastructure requires substantial financial investment and many rural areas face budgetary constraints to allocate. Collaboration among the government, private sector, and non-profit agencies can provide additional resources. Sustainable financing may be achieved through public-private partnerships, resulting in continued growth and investment in these projects.

Swaraj India's infrastructure development initiatives have transformative effects. Through the establishment of research centers, laboratories, and agricultural extension services, the movement provides the information and technology necessary for informed decisions and best practices. Traditionally reliant farmers can harness impressive scientific expertise to enhance their yields and income. Moreover, these infrastructural improvements foster

a culture of continuous learning. Farmers participate actively in research projects, working alongside scientists and contributing their indigenous knowledge in on-farm trials. The integration of scientific knowledge with cultural traditions weaves a rich fabric of agricultural innovations that combine old practices with contemporary developments. These infrastructure developments have far-reaching economic effects in rural areas. The adoption of improved farming methods leads to higher-quality crops and increased income, ultimately raising living standards. This economic empowerment has a ripple effect, boosting the local economy and resulting in higher investments in education, healthcare, and overall quality of life, generating a positive cycle of prosperity that uplifts entire communities.

Research Institutes and Centres to Pioneer Innovation and Progress

The cornerstone of Swaraj India's infrastructure development strategy revolves around modern research centers. These centers serve as platforms for collaboration between researchers and agriculturalists, who work together to advance the frontiers of agricultural research. These centers explore new techniques, crop varieties, and sustainable systems based on the needs of rural communities, engaging in research, experimentation, and trial methods. Furthermore, these research centers are instrumental in driving agricultural innovation. They contribute to the development of drought-resistant crops, pest-resistant varieties, and climate-smart agriculture. By incorporating indigenous and locally adapted solutions, these centers enable farmers to cultivate suitable crops, increase agricultural output, and reduce the negative impacts of production on the environment.

Swaraj India also maintains state-of-the-art and well-equipped laboratories that work in conjunction with the research centers, enabling in-depth and complex investigations. These laboratories are hubs of scientific inquiry, where researchers delve into the molecular aspects of agriculture, including genetics, soil science, and plant genetics. Such research provides insights into crop responses to diseases, their ability to withstand environmental stressors, and their nutritional content. Laboratories play a pivotal role in conducting quality control measures, subjecting products to rigorous testing to ensure that crops are free from contamination. This not only upholds quality standards for domestic consumption but also enhances the international marketability of Indian agricultural produce, resulting in additional income for farmers abroad.

The establishment of research centers, laboratories, and agricultural extension services by Swaraj India represents a beacon of hope for rural empowerment. These infrastructural developments provide the groundwork for future innovations and knowledge sharing, ultimately contributing to the development of a sustainable rural economy in India. Through this holistic approach, Swaraj India strengthens the country's agriculture foundation and lays the groundwork for a prosperous future for future generations. As farmers embrace the latest farming methods and adapt to changing climates while participating in the global market, Swaraj India's vision for a vibrant and independent Indian rural community is steadily becoming a motivational reality.

Agricultural Extension Services

Agricultural extension services are a key component of Swaraj India's infrastructure development strategy. These services bridge the gap between research outcomes and their practical application, ensuring farmers can access scientific advancements in their fields. Modern tools and knowledge are integrated into the work of extension workers, who collaborate with local communities to advise on best farming practices, pest control, and crop rotation. Furthermore, these extension services provide farmers with critical data on changes in market trends and consumer preferences over specific periods. This empowers farmers to grasp market dynamics and tailor their production to meet consumer preferences, enhancing product quality and demand. This market-oriented approach increases farmers' incomes and supports the development of environmentally friendly agriculture.

Skill Development Programmes

Swaraj India's skill development programs are carefully designed to be inclusive and transformative. These initiatives focus on imparting a diverse range of skills, from technical expertise to managerial acumen. Swaraj India offers specialized training programs that cater to the unique demands of rural areas, ensuring that everyone, regardless of their educational background, has the opportunity

to participate and benefit from these programs. Implementing skill development programs for local residents equips them with the knowledge to maintain and operate the established infrastructure. Training individuals from the local community as technicians and caretakers ensures the sustainability of these facilities. In the broader context of rural development, Swaraj India's commitment extends beyond the mere establishment of research centers, laboratories, and agricultural extension services. True transformation arises from creating these vital resources and empowering local communities to manage them effectively. Swaraj India is leading this effort by developing skills training programs tailored to rural needs, equipping citizens with the knowledge and skills to effectively manage and sustain rural infrastructure.

Nurturing the Technical and Managerial Skills of Local Experts

Recruiting and training local individuals as technicians form one of the cornerstones of Swaraj India's strategy in skill development programs. These specialized programs provide comprehensive training on how to effectively utilize agricultural machinery, laboratory equipment, and other technical resources within an established framework. Swaraj India equips individuals with technical expertise to ensure the efficient operation of facilities and cultivates a reservoir of skills within the community. These programs also place a strong emphasis on the repair and maintenance of agricultural machinery, reducing downtimes for farmers and optimizing agricultural operations. Local participants become skilled technicians capable of diagnosing and rectifying faults, performing routine maintenance, and extending the lifespan of agricultural machinery through a combination of hands-on training and theoretical knowledge. This technical proficiency enhances individual farmers' productivity and elevates overall agricultural performance in the region.

In addition to technical skills, Swaraj India's skill development program includes managerial training and leadership development, among other related responsibilities within rural communities. This component encompasses instruction on topics such as project management, financial budgeting, and organizational leadership. Through the development of managerial skills, Swaraj India empowers individuals to assume daily control of farm operational activities, efficiently use available resources, and make informed decisions through guidance. These programs also emphasize entrepreneurship training, encouraging individuals to explore opportunities in agribusiness. Participants receive training in business planning, market analysis, and how to establish and manage their own farming enterprises. Swaraj India fosters entrepreneurship, providing employment opportunities and economic expansion, resulting in increased financial independence for rural residents.

The broader community also benefits from Swaraj India's skill development initiatives. Individuals possessing basic managerial skills are viewed as well-equipped with leadership abilities within the community. They initiate and supervise development programs, engage with other institutions, and represent their community in various meetings. This leadership promotes unity, encouraging people to work together and collaborate on development projects. Furthermore, the growing spirit of entrepreneurship in these programs enables the establishment of small business enterprises and cooperatives. Communities embark on their own agribusiness endeavours, such as agro-tourism and food processing. These initiatives create job opportunities and contribute to economic growth, ultimately improving living conditions in the concerned communities. Swaraj India empowers local individuals to become job creators rather than mere job seekers, reducing unemployment and poverty in rural areas while fostering entrepreneurship.

Formulating Supportive Policies

Supportive policies aimed at promoting Swaraj in the agricultural sector are crucial. In this regard, the government collaborates with research institutes and educational centers to develop strategies that offer farmers incentives for adopting sustainable farming practices, provide them with funding, and encourage organic agricultural methods. These policies enable farmers to embrace modern and sustainable farming practices.

- *Subsidies and Grants*: The government provides financial support through incentives, subsidies, and grants to farmers who embrace sustainable farming practices. These incentives may include funding or subsidies for eco-friendly fertilizers, solar-powered machinery, and water-saving irrigation systems.

- *Crop Insurance Schemes*: The policies provide crop insurance to protect farmers' crops in case of natural disasters such as droughts, pests, or diseases. These insurance guarantees give farmers the confidence to pursue sustainable approaches, knowing they would not bear irreparable costs in the event of crop loss.

- *Financial Assistance*: Specialized loan schemes with low interest rates are designed for farmers, enabling them to invest in modern farming equipment, organic farming methods, and sustainable technologies. Additionally, research institutions and educational organizations receive grants to conduct research on sustainable agricultural practices. This funding fosters innovation and the development of new, eco-friendly farming techniques.

Promoting Organic Agriculture

- *Certification and Standards:* The government collaborates with certifying bodies to establish standards for organic produce. Farmers adhering to these standards receive certification, ensuring premium prices for their organic products in the market.

- *Market Access*: Policies are formulated to facilitate organic farmers' access to local and international markets, encouraging the expansion of organic agriculture. This includes creating marketing cooperatives and organizing organic produce fairs.

- *Training and Awareness*: Education is provided through training courses and workshops for farmers on how to engage in organic farming, create compost, and implement all-natural pest control methods. Public awareness campaigns are often initiated to educate consumers about the benefits of organic produce, further driving demand for organic farming.

Regulatory Guidelines and Support

Clear regulations have to be established to govern organic farming practices, ensuring the authenticity of organic products. Strict enforcement deters fraudulent practices, building consumer trust in organic produce. Organic farms are monitored and certified by regulatory bodies. Frequent checks ensure that farmers observe the laws of organic farming to maintain high-quality standards within the organic farming sector. The government ensures farmers have a conducive environment by developing comprehensive policies and support programs. This promotes sustainable and organic farming, uplifts the rural economy, provides food security, and protects the environment.

Conclusion

In the grand vision of Swaraj India, the development of physical infrastructure and empowerment of skills intertwine to create a self-sufficient and prosperous rural India. *Swaraj* India establishes research centers, laboratories, and agricultural extension services while simultaneously training a skilled labour force capable of managing these assets in a way that promotes sustainable rural development. Local individuals become technically proficient, professional, and entrepreneurial citizens through technical knowledge, managerial skills, and a spirit of entrepreneurship. In return, they become the architects of their destiny and create a bright and prosperous future for rural India. These programmes within *Swaraj* India's vision act as a catalyst, leading to a self-reliant, dynamic, and resilient rural India that can overcome challenges, seize opportunities, and work toward success. Over time, communities learn how to manage their resources, implement innovation, and foster entrepreneurship, ultimately achieving self-sufficiency that inspires neighbouring regions, thereby revolutionizing agriculture across the country. When in the hands of capable and empowered individuals, *Swaraj* India's vision becomes a reality, illuminating the path to a brighter and more prosperous life for each rural community in all states of the country. In conclusion, achieving self-reliance and empowering farmers in Swaraj India, greatly depends on science education and research in agriculture. India's agricultural sector can be transformed to provide food security, environmental conservation, and the well-being of farming communities, all in the spirit of *Swaraj.*

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Triple Helix for a Sustainable Funding Model for Research and Innovations in Higher Education: A Global Reality

D K Ghosh*

According to Altbach, "Universities since their origin in medieval Europe, have always been concerned with the transmission, preservation, and interpretation of knowledge, although not primarily with the creation of new knowledge (Altbach 2016).

But humans because of their very nature have always been curious to seek new knowledge and over time, individuals in civilized society, as we know, have at different times in different parts of the world, worked tirelessly with self-motivation and gifted the society with their invaluable discoveries and inventions.

Beginning of University Research

As regards institutional research, the world's first University research laboratory was established in 1825 by Professor Liebig of Giessen University of Germany (Willet 2015). Until the early part of the twentieth century, universities did not have external funding for research. In fact, activities of the university until the early post-II World War period, were mostly limited within their campus boundaries with little interaction with the outside world. Mostly, Clergymen dominated the university in governance and a number of them also taught students. They were replaced later in the middle of the twentieth century when the university needed funds, by businessmen (Bok 1982).

Strangely, in England, until 1917, there was no research in universities for doctorate degrees. The first D. Phil (as called in Oxford until today) was conferred only in 1917. According to David Willet, in England, "… there developed no structured research capabilities like Germany and later America. They were content doing only undergraduate collegiate teaching. Without creating new knowledge, there cannot be a vibrant university. So, the "seventeenth and eighteenth centuries saw Oxbridge in decline," (Willet 2015).

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First Time How American Universities were Involved by Federal Government for Research

Admittedly, American universities are examples and role models to the world for both research and development. After the Second World War "the federal government based on its wartime experience provided the mechanism and money to support a massive program of basic research on the nation's campuses," (Bok 1982). However, "Ironically, it was through the development of weapons that academic scientists proved how valuable their talents could be to the modern industrial state," (Bok 1982). Slowly, universities started participating and contributing to government-funded research. In the post-1945 era, "Washington took further initiatives to encourage universities, private as well as public, to meet important national needs," (Bok 1982). The need to involve private was later realized for economic growth.

However, in the USA, Corporates have a track record of taking initiatives for interaction with universities even before the Second World War. They had started funding universities for research, spending "a significant portion of the meager budgets for campus-based research. But after 1950, because of significant federal funding to universities for research, corporate funding declined to an extent". Consequently, for some time, there was a temporary pause for applied research although federal funding to universities was for basic research. In this connection, Derek Bok, the Emeritus President of Harvard University, observed, in 1982 that with liberal federal funding for basic research in universities which helped them build good infrastructure, the university-industry relationship declined to a stage that universities did not give importance to applied research, and because of this, the industry thought that the universities were impractical. Thus, they drifted away from each other," (Bok 1982).

After two wars, the role of America in world affairs increased manifold and continued to grow. In order to meet important national plans, "additional sums were given to produce specialists on far-off

regions of the globe," (Bok-1982). Slowly, the federal government started involving faculty of universities who were too happy to respond that would give them opportunities of a different dimension for their future academic career.

It was Vannevar Bush (not connected with ex-President Bush's family) who was then the Dean of Engineering at MIT in 1932 and later President of the Carnegie Institution and the Founder Chairman of the National Research Development Committee (NRDC) of America at the time of the Second World War, who was credited with the new policy of the federal government to outsource various federal research responsibility to the leading universities of America. He always felt that universities are the right places for various research activities of the federal government for they are the ones who have both brilliant and committed academics and scientists with facilities to carry out research.

As the story goes, post Second World War, in 1945, Bush had suggested to President Truman that the leading universities of America should be the base of federal research. That led to liberal research funding to leading universities. "By the 1960s, it was said that it had become difficult to tell whether MIT was 'a university with many government research laboratories appended to it or a cluster of government research laboratories with a very good educational institution attached,"(Willet 2015).

Triple Helix for Research and Innovations --- The Government-University-Industry

Admittedly, for sustainable, smooth, efficient, meaningful, and productive research and innovations in the higher education system, the pre-requisite is the *Triple Helix- the Government-University-Industry.*

Of the three players, the first is the all-powerful Government for it has *inter-alia*, powers to make legislation and to issue directives, the option to offer incentives to industry by way of tax concessions and requisite facilities to boost academia-industry collaborative research and make it a win-win situation for all players in this in this game to boost the economy.

The Government has also money for basic research in identified areas. It has also the power to encourage and direct the university to accelerate academia-industry interaction. The second but the real player in the process is the University for it is the power-house of knowledge and expertise in their faculty and scientists who are endowed with the knowledge and skill to translate into realities their brilliant ideas in products and services. The third player is the Industry which would always look for opportunities to invest in collaborative research work and make money from saleable products and services in both domestic and global markets.

Role of the Government

Conceptually and in reality too, the government is responsible inter-alia to ensure good economic performance of the country amid a competitive world market and to do all that is necessary to promote the same. The government has the inherent power to frame a favourable policy to incentivise the industry for collaborative research with academia. It has also the power to encourage and direct the university to increase industrial collaboration.

The best example is the federal government of the USA which for the first time in history, recognized the capability of the university teachers and scientists about their powers and potential. Unfortunately, however, as Derek Bok, said that unfortunately, that was when the federal government wanted to dominate the world through the development of weapons using the university faculty and scientists.

China, in recent times, offers the best example in this regard. The government took proactive and sustained initiatives to promote and boost academia-industry interaction to coincide with the country's huge quantum- leap in economic growth. For this, initially, beginning in the 1990s, the government was at the forefront of doing everything to upgrade the faculty expertise for academia-industry interaction for which it needed the powerful industry of America to forge long-term links with a physical presence in Chinese universities so that over time, the university gets strong enough to independently lead.

For this, the government did everything to accelerate the process. The American industry also wanted entry into China for business and to expand its commercial interests. Over time, as the university grew in strength and took the position of equal partnership with global industry, the government silently became an invisible partner, although always ready to support it. The example is of the Tsinghua University-UTC (now merged with Raytheon Technologies)[4].

Precisely, the role of the government in Triple Helix is to declare its policy to do everything for intensive academia-industry collaborative research for quality products and services for both domestic as well as international markets in the interest of the economy of the nation. That is what the Chinese government did for over three decades. Now that the objective has been achieved, it now plays an invisible role.

The government with its stake in everything that matters for the national interests, provides funds for basic research, applied research, and to an extent for the development of products. The extent of funding for different areas would depend on a variety of factors such as policy and resources and in that it has always to fix priorities. However, for obvious reasons, it would be different in different countries.

Again, to refer to the American scenario in this regard, the federal government and businesses have always set examples of liberal funding for research and development. For example, in 2020, the Federal Government funded 40.6% for Basic Research, 31.3% for Applied Research, and 10.9% for Development.[5]

In Japan, taking a new initiative, the Government wants corporates who are reluctant partners in research collaboration, to lure more industry funding into universities, but companies need to be convinced that they'll get value. The government is now, ".. prioritizing industry–academia collaboration "to generate innovations that have a positive impact on society."[4]

The government is also encouraging companies to triple their R&D investment in academia by 2025, paying particular attention to areas such as artificial intelligence, big data, sensors, and optical technologies, which complement the areas where companies are already investing.

How Much Nation's Research Suffers When Government Funding Declines–Research Universities and the Future of America

Due to a considerable decline in Research Funding for universities, American universities were losing their about century-long pre-eminence in research and development. Because of this, the US Congress was concerned about the Stagnant Research in America. "Expressing concern that the nation's universities are at risk, the U.S. Congress asked the National Academies to assess the competitive position of America's research universities, both public and private, and to respond to the following question:

"What are the top 10 actions that Congress, the federal government, state governments, research universities, and others can take to assure the ability of the American research university to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, the environment, and security in the global community of the 21st century?"[6]

The National Academies of the USA are mandated to advise the Senate in each one's area. The three Academies are for, Sciences, Engineering and Medicine. In order to delve deep into the various causes responsible for the current situation in research universities, the National Academies decided to form a "committee of individuals who are leaders in academia, industry, government, and national laboratories."

While deliberating on the relevant issues in depth, the committee found that "these institutions now face an array of challenges, from unstable revenue streams and antiquated policies and practices to increasing competition from universities abroad. It is essential that we as a nation reaffirm and revitalize the unique partnership that has long existed among research universities, the federal government, the states, and philanthropy, and strengthen its links with business and industry. In doing so, we will encourage the innovation that leads to high-quality jobs, increased incomes, and security, health, and prosperity for our nation"[6]

With the title 'Research Universities and the Future of America', the Committee made Ten Recommendations under three broad categories as follows:

- Revitalizing the Partnership.
- Strengthening Institutions.
- Building Talent.

The specific Ten Recommendations that have been categorized covering the above three areas are:

- Federal Action.
- State Action.
- Strengthening Partnerships with Business.

- Improving University Productivity.
- Strategic Investment Program.
- Full Federal Funding for Research.
- Reducing Regulatory Burden.
- Reforming Graduate Education.
- STEM Pathways and Diversity.
- International Students and Scholar

Recommendations are Crucial to Regaining America's Research Leadership

The above areas of recommendations speak volumes about the correct assessment of the position and what must now be done to regain the leadership of American universities like before. The concluding part of the report which runs as follows precisely conveys the message.

"Today our nation faces new challenges and a time of rapid economic, social, and political transformation driven by an exponential growth in knowledge and innovation. A decade into the 21st century, a resurgent America must stimulate its economy, address new threats, and position itself in a competitive world transformed by technology, global competitiveness, and geopolitical change. In this environment, educated people, the knowledge they produce, and the innovation and entrepreneurial skills they possess, particularly in the fields of science and engineering, are keys to our nation's future. We must reaffirm and revitalize the unique partnership that has long existed among the nation's research universities, the federal government, states, philanthropy, and business. The actions recommended here will require significant policy changes, productivity enhancement, and investments on the part of each member of the research partnership. Yet they also comprise a fair and balanced program that will generate significant returns for a stronger America."

The great research universities now need to be refurbished with new vigor with liberal funds like before so that they can offer more valuable gifts to mankind through their research and innovations at a time when the world is still not free from the fury of COVID-19 with more variants and sub-variants which continue to threat the mankind.

The Biden Administration has proposed to allocate USD 50 billion to NSF for promoting research in universities which augurs well to strengthen the existing research funding of the Foundation.

Role of the University

The University is a Knowledge Factory. Wherever it is located, it attracts talents, people, and corporate research organizations and it even helps create a new City. Stanford University is credited with the rise of the Silicon Valley in Palo Alto which is a dynamic global city and is located just outside Stanford at a distance of about five minutes. The university played a crucial role in the emergence of Silicon Valley which has been immensely benefitted by the proximity of Stanford which is a knowledge powerhouse. This makes it clear why Industry is attracted to academia for its benefits. It is a win-win situation. The two together are capable of boosting products and services for domestic and global markets through their innovations and research. That is why the government wants more and more applied research for products and processes to compete in the world market which in turn brings prosperity to the nation. Precisely, in the research and development activities, the role of the university is most significant.

The university system has made many contributions to human society through their research activities for example, a large number of breakthrough-benefits came to mankind from the laboratories of universities such as 'polio vaccines and heart pacemakers; municipal water-purification systems'. University laboratories have also gifted space-based weather forecasting, advanced cancer therapies, etc.

China's Tsinghua University as a Good Example for Emerging Research Universities

The Chinese government recognized in the early 1990s the realities of the globalized world which fuelled competition among nations for goods and services, international travel, and business. It had realized that to make an impact in the world market, innovations and research are a sine-qua non. For that, it had planned to first create 100 world-class universities which later was limited to 9, under the C9 scheme.[4]

The Chinese government had planned that the knowledge and expertise of the knowledge factory ie university should flow smoothly to the fast-growing industry of various shapes and sizes to ramp up production and economy to create a world market.

Of the nine, Tsinghua University which was also the best university in China, grew tallest in the country. It is now one of the 16 top globally ranked

(2022) universities of the world. Tsinghua's annual budget is of US$ 4 billion.

Global Reach of Tsinghua's Holdings

Tsinghua has grown very big in all respects including its R&D activities which today has a global reach. For its international business, it focuses on electronic technology, alternative energy sources, energy-saving and environmental protection, bio-pharmaceuticals, science and technology services, publishing, and food.

"The company has 111 overseas subsidiaries, mainly in the US and the Canadian province of Ontario in North America; Brazil, Venezuela, Argentina, and Panama in South America; the Netherlands, the UK, Germany, Belgium, Poland, Finland, and Turkey in Europe; Australia in Oceania; Japan, and South Korea, Singapore, Vietnam, India, the UAE and China's Hong Kong and Taiwan in Asia." In 2017, "total operating income was 141.1 billion yuan, up from the same period of last year; net profit was -1.79 billion yuan, the same period last year. It is a profit of 6.3 billion yuan". [4]

Role of the Industry (Business)

Admittedly, the industry of the USA is well known and well credited with its huge role in promoting not only Applied Research and Development but also Basic Research. For example, the Business (Houses) is credited with liberal funding of 33.5% for Basic Research which in general in most countries, businesses would not fund for basic research. As for Applied Research, it funded 56.3%. It funded a whopping 87.4% for Development.[5]

No other country- be it the UK, Germany (or the rest of Europe), Australia, Canada, Japan or China matches the culture of industry interaction with the university. Elsewhere, on the pretext of some reason or other, the university does not get an easy response from the industry. Australian industry says that it is not big enough to respond well. Some industries in Japan adopted a policy to invest in quality publications by its people while the response of others is lukewarm. However, in all countries, a few industries would always find interest in interaction with academia which is not enough.

Undeniably, industry in other countries is not as big and proactive for collaborative R&D activities as it is in America. In Japan, "… corporates make reluctant partners. The Japanese government wants to lure more industry funding into universities, but companies need to be convinced they'll get value".[4]

Yet, realizing the importance of industry partnership with academia, the government is determined to make all-round efforts to promote UIC. Therefore, ".. it is also prioritising industry-academia collaboration "to generate innovations that have a positive impact on society." However, Uchino lamented that. ".. the relationship so far has been fraught."

The government is also "encouraging companies to triple their R&D investment in academia by 2025, paying particular attention to areas such as artificial intelligence, big data, sensors and optical technologies, which complement the areas where companies are already investing.

In Australia, "Business collaboration on innovation is low and towards the bottom of the OECD league table. Moreover," Indeed over 80% of those Australian firms who innovate do not collaborate," Further, "Innovation in Australian firms is heavily tilted towards modification of innovations introduced by other Australian firms, while there is much less engagement in "new to market" innovation (perhaps the most valuable type). In this, Australia languishes towards the bottom of the OECD" (Lecture of VC of Monash University).

In Germany, according to an important Study 4 undertaken on 'The State of University Business Cooperation in Germany and its relative position in the whole of European Commission, undertaken with the support of the European Commission (2013), eight types of *University Business Cooperation (UBC)* were identified for the entire European Union of which Germany is a constituent.

Eight Types of University Business Cooperation (UBC) in Germany

Collaboration in R&D: It includes joint R&D activities, contract research, R&D consulting, cooperation in innovation, joint publications with firm scientists/researchers from HEIs to business, Master or Ph.D. or Projects in cooperation with business

Mobility of Academics: It Consists of the temporary movement of professors, and researchers

from HEIs to businesses, and employees, managers, and researchers from businesses to HEIs

Temporary Movement of Students: It consists of the temporary movement of students from HEIs to businesses to involve them in practical and research-oriented activities based on their interests and ability

Commercialisation of R & D Result: It includes commercialization of R&D results through disclosures of invention, patenting, and licenses.

Curriculum Development and Delivery: They consist of the joint development of a programme of courses modules, majors or minors, planned experiences, or well or guest lectures by delegates from external private and public organisations within undergraduate, postgraduate, or Ph.D. programmes.

Life Long Learning: This includes the provision of adult education, permanent education, and/or continuing education involving the acquisition of skills, knowledge, attitudes and behaviors by HEIs to people working in the external organization.

Entrepreneurship: It consists of actions including HEIs towards the creation of new ventures or developing entrepreneurial mindsets in cooperation with business.

Governance: It *i*ncludes academics involved in firm decision-making or sitting on the boards of firms and also having business leaders involved in HEIs decision-making or sitting on the boards of HEIs or at a faculty management level."

These areas provide a wide range of collaborative activities between the University and Industry. They are complementary to each other. About the eight identified parameters, when compared with the rest of European countries, it is found that Germany is ahead of the EU concerning three of the eight types, namely, Collaboration in R&D, Commercialisation of R&D results, and Mobility of students. Concerning Entrepreneurship and Mobility of Academics, Germany is marginally less than the EU. But in the areas of Governance and Life-long learning, Germany is behind the EU.

In respect of R&D collaboration, the study concluded that Germany is decidedly ahead of all other countries of the EU as highly developed. Concerning all other areas, both Germany and other EU countries are 'Moderately developed.Interestingly, Bureaucracy is considered the highest barrier by academics in Germany which needs to be addressed to further increase German UBC

Perceived Major Drivers for UBC

Based on responses, the study found that an important area that promotes various activities including UBC is 'Relationship'. German HEI management and academics alike name relationships as the drivers of UBC. As in Europe generally relationship drivers such as "(1) existence of 'mutual trust', (2) 'existence of mutual commitment' and (3) 'having a shared goal' were nominated as the biggest drivers of UBC. This suggests that greater effort to bring academics and business, with space for relationship building, could make UBC more meaningful.

Distinction between Agency Funding and Investments by Business

The study has rightly pointed out the necessity to understand the "distinction between funding (grants from Research Councils, charitable bodies) and investments (business angels, venture capital) both of which can be used to fund product development trials.". This distinction is since "Funding is more common than investment in the early stages of development where the market opportunity is very specific and potentially limited (investment is hard to attract at the earlier stages)".

New Trends of University-Industry for Collaboration Like the IBM Global University Programme

There appears to be a new trend in both-universities and companies - to look for more flexible collaboration that goes beyond not only one site, and one location, but beyond the state and borders which is international. This also provides opportunities to choose the best-suited partner.

Another growing trend is that both- the university and industry- are looking for a physical presence of industry with some of its staff and facilities on the university campus. IBM Global University program is one to support this approach which will help universities in several ways.

For example, long-term collaboration will help develop a good relationship understanding each

other's needs and potential for meaningful interaction for future projects. With the physical presence of industry on the campus, the university might draw a few Adjunct faculty which will make both happy. Even academics might be associated with the industry in their committees and boards for decision-making. Students, in particular postgraduate and research, will find it easy to interact with industry personnel and research projects. The IBM Global University scheme has turned out to be a successful model.

National Research Foundation (NRF)

For the first time, in India, based on the recommendation of NEP, 2020, the Government of India has passed the *Anusandhan* National Research Foundation (NRF),2023, which opens up a whole new vista of opportunity for funding research opportunities to Indian universities which so far was missing.

The Act provides the following for funding research in the country: "Key functions of NRF include: (i) preparing short-term, medium-term, and long-term roadmaps and formulating programs for research and development (R&D), (ii) facilitating and financing the growth of R&D and related infrastructure in universities, colleges, and research institutions, (iii) providing grants for research proposals, (iv) supporting the translation of research into capital intensive technology, (v) encouraging international collaboration, (vi) encouraging investments in the Foundation by private and public sector entities, and (vii) undertaking an annual survey of scientific research outcomes, and spending".(Source: PRS Lok Sabha Research)

Research Funding is Invariably Competitive

Funding for Research has always been competitive which makes it clear that a university seeking funding for a research project has to compete with a growing number of academics and institutions vying for the same. This speaks a lot about the preparations needed for vying for research funds. According to a Times Higher Education Article, "Even in disciplines in which research is inherently inexpensive, 'grant capture' is increasingly being adopted as a metric to judge academics and universities. But with success rates typically little better than one in five, rejection is the fate of most applications."

Some of the good advice that comes from the Article is that "(1) there is no sure-fire way of being successful, (2) writing a good proposal is critical to be impressively presented along with Visuals of high resolution. Importantly, "Assessors looking for projects that will achieve something (this may be a critical breakthrough or conceptual advance). But they are also looking for approaches that offer a new way into big issues, not just ones doing more of the same".[7]

Clearly, in an environment of Market Forces where the gold standard is the yardstick, the university has to ensure its strength for carrying out research in focused high-end areas, with all essential attributes that will pave its way to compete and win research funding.

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Fostering Interdisciplinary Research: Benefits and Pathways

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Interdisciplinary research has recently gained significant importance because the problems we face as a species are becoming increasingly complex and require a multidisciplinary approach to find practical solutions. Many of the pressing problems society faces today require solutions based on an interdisciplinary approach. Issues such as climate change, public health, and urbanization require a multifaceted approach that draws on expertise from various fields. By breaking down traditional silos and promoting collaboration across disciplines, interdisciplinary research can unlock new insights and innovations that can help build a better future. Underlying the need for interdisciplinary research, Duerr and Herkommer (2019) observes, "In this day and age, science and research need to come up with better and more effective solutions for various challenges and to analyse complex systems that often call for crossing disciplinary boundaries to generate new knowledge and to drive innovation." (p. 103)

With the rapid advancement of technology and the increasing complexity of societal issues, interdisciplinary research has become necessary. Interdisciplinary research enables researchers to tackle complex societal issues by combining knowledge and methods from multiple disciplines. Interdisciplinary research, as a collaborative approach, involves experts from multiple disciplines working together to address complex problems and challenges. The goal of interdisciplinary research is to bridge the gaps between different fields of study and generate innovative solutions. By integrating knowledge and methods from different fields, interdisciplinary research can lead to more comprehensive and practical solutions to complex problems. Researchers with experience working across disciplines are better equipped to tackle these challenges and develop holistic and sustainable solutions to make the world a better place.

Interdisciplinary Research

Interdisciplinary research has been defined in several ways. The popular notion is that interdisciplinary research involves researchers from two or more disciplines working for a common goal or problem. However, interdisciplinary research is much more than this as it is an outcome of collaboration between researchers from two disciplines and a collaboration of their methodologies and research designs. A report from the National Academy of Sciences (2005) highlights that,

> Interdisciplinary research is any study or group of studies undertaken by scholars from two or more distinct scientific disciplines. The research is based upon a conceptual model that links or integrates theoretical frameworks from those disciplines, uses study design and methodology that is not limited to any one field, and requires the use of perspectives and skills of the involved disciplines throughout multiple phases of the research process. (p.2)

Interdisciplinary research is a crucial approach to addressing complex societal issues. By combining knowledge and methods from multiple disciplines, researchers work together to find innovative solutions and scientific breakthroughs. This type of research involves collaboration among experts from various fields and integrating different concepts, methods, and data. Interdisciplinary research is unique in its ability to integrate different perspectives and approaches, which can lead to more comprehensive and practical solutions. According to Aboelela, et. al. (2007),

> Interdisciplinary research is any study or group of studies undertaken by scholars from two or more distinct scientific disciplines. The research is based upon a conceptual model that links or integrates theoretical frameworks from those disciplines, uses study design and methodology that is not limited to any one field, and requires the use of perspectives and skills of the involved disciplines throughout multiple phases of the research process. (p.341)

Here, it is essential to consider that interdisciplinary research is not an adversary to traditional discipline-oriented research. Instead, it offers more opportunities to add value to it. By bringing together experts from different fields, interdisciplinary research can provide a broader perspective, leading to more creative and effective solutions. Moreover, interdisciplinary research can help overcome the limitations of traditional disciplinary boundaries, which can sometimes hinder progress. Newman (2023, p.13) notes, "In addition to discipline-based research, interdisciplinary research can add value greater than the sum of its parts. There is, therefore, understandable interest in how interdisci-

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plinary research can be increased, without diminishing discipline-based research." Therefore, it becomes significant to delve into the perceived benefits of interdisciplinary research.

Perceived Benefits of Interdisciplinary Research

The most notable call for fostering interdisciplinary research emancipates from the fact that it can help break down the traditional silos that exist in academia and promote collaboration across disciplines. There is also a widespread perception that interdisciplinary research can lead to exciting discoveries and innovations. The nature and approach of interdisciplinary research make it vital for advancing knowledge and innovation and solving complex real-world problems. The assumption is that by working together, researchers can combine their expertise to tackle problems too complex for any discipline to solve alone. The claim is that interdisciplinary research can help foster collaboration and communication between researchers from different fields, leading to a more integrated approach to research and development. Emphasizing the three main arguments in favour of promoting interdisciplinary research, Duerr and Herkommer (2019) note,

> First, complex problems are often not suitable for single-discipline research anymore. Second, discoveries and advances in research and development are more likely to happen at the borders between multiple scientific fields. Finally, and most importantly, the interactions between researchers from different disciplines benefit each individual and broaden their horizons. (p.103)

Interdisciplinary research brings together experts from different fields to work on a common problem or question, leading to new insights and discoveries that would not be possible through traditional disciplinary approaches. With the rapid pace of technological change, new technologies are constantly emerging and often have implications for multiple fields. Interdisciplinary research can help identify and understand these implications, leading to new applications and innovations that take advantage of these technologies. Another argument is that collaboration and communication across different fields are essential for tackling complex problems and driving innovation, and interdisciplinary research provides a platform for such collaboration.

Creating More Comprehensive and Holistic Solutions to Complex Problems

Interdisciplinary research allows for integrating various perspectives, methods, and theories, leading to more innovative and effective solutions and helping solve complex problems. Interdisciplinary research can help in breaking down the traditional silos that exist in academia and promote collaboration across disciplines. By bringing together experts from different fields, interdisciplinary research can yield insights and solutions, usually challenging through a single discipline. It allows for a more comprehensive and holistic understanding of the problem and can lead to more innovative and effective solutions. Interdisciplinary research can also encourage collaboration and communication across fields, leading to new ideas and approaches. Interdisciplinary research can be a powerful tool for addressing complex real-world challenges that a single discipline cannot solve.

Developing New Insights and Knowledge

Interdisciplinary research has been instrumental in developing new research questions and areas of inquiry. By combining different fields of study, researchers can identify new research questions that would not have been possible to discover through a single-discipline approach. Interdisciplinary research involves collaboration between researchers from different fields to develop new research areas that combine expertise from multiple disciplines. By bringing together diverse perspectives and knowledge, interdisciplinary research can lead to innovative solutions to complex problems that are difficult to solve by a single discipline alone. It can also bridge gaps between fields and promote cross-disciplinary communication and understanding. Interdisciplinary research can also help develop new knowledge and insights that could contribute to humanity and society in many ways.

Advancing Scientific Discovery and Encouraging Innovation and Creativity

Interdisciplinary research can help researchers develop a broader skill set and a more diverse network of colleagues, which can be invaluable in advancing their careers. Usually, the researchers are trained to work in their disciplines. While such training is essential for ensuring excellence in a particular field, it may hinder researchers' ability to be competitive in their research careers. In comparison, participation in interdisciplinary research can help researchers develop a more holistic approach. By collaborating across different fields, researchers can gain new perspectives and insights that may not have been possible otherwise. This approach gives researchers a more comprehensive understanding of complex problems and can lead to more innovative solutions. Participating in and

practicing interdisciplinary research can help prepare better researchers for the future.

Leading to New Research Partnerships and Opportunities

Interdisciplinary research can be a great way to broaden opportunities for new research projects. Many funding agencies and organizations are interested in interdisciplinary research because of its potential to address complex problems. Collaborating with researchers from different fields can increase the likelihood of obtaining funding for research projects. It can also help secure funding from multiple sources, as it is often more appealing to funding agencies to support projects that involve collaboration across disciplines. Additionally, interdisciplinary research can produce more impactful and relevant outcomes as it considers broader perspectives and expertise. By participating in interdisciplinary research, researchers can draw the attention of funding agencies and academic institutions to provide resources and support for advancing scientific knowledge.

Potential Pathways for Fostering Interdisciplinary Research

The importance of interdisciplinary research cannot be overstated, especially considering the perceived benefits and complex societal issues that require a multifaceted approach. Institutions and their leadership must promote and prioritize such research to address these challenges effectively. It is significant to mention that institutions need to work on breaking down the traditional barriers between academic disciplines and promoting collaboration-driven interdisciplinary research, leading to new insights and innovations. The ways to foster interdisciplinary research include creating opportunities for scholars from different fields to collaborate and work together towards a common goal, creating interdisciplinary research centers, having joint appointments, conducting cross-disciplinary training programs, promoting collaborative research projects, and conducting interdisciplinary workshops and conferences. In addition to these, other measures can also significantly help in promoting interdisciplinary research.

Encourage Collaboration among Researchers from Different Disciplines

Collaboration is the buzzword for promoting interdisciplinary research. Roper (202, p.24) notes, "Collaboration is a process in which different parties are involved in the design, knowledge sharing, and production, as well as feedback, of a project. Within academia this generally means (but is not limited to) co-creation of a piece of research by multiple researchers." Unfortunately, conventional disciplinary scholarship creates boundaries where researchers tend to work within and hardly move to collaborate and work with researchers from other disciplines. As noted by Bruhn (1995),

> For years, the world of learning has been divided into disciplines characterized by rigid specialization, both in thinking and in method of inquiry. Ironically, as educators and scientists sought to protect their disciplinary boundaries, the newly emerging problems that needed solutions became more global, complex, and ill-defined. (p. 331)

Interdisciplinary research demands a culture of collaboration where, in addition to collaborating with researchers from the same discipline, researchers must also collaborate with researchers from other disciplines. As an essential step in this direction, it is significant to realize that interdisciplinary collaboration in research is a piece of research carried out by researchers from different disciplines and subject backgrounds (Dollinger, et. al., 2018). Sometimes, it can be challenging to venture outside one's familiar disciplinary territory, especially when the culture discourages interdisciplinary scholarship. However, it is essential to remember that innovation often arises from cross-disciplinary collaborations and exploring new spaces. Therefore, it becomes vital for institutions and educational leadership to promote and suggest "practices for researchers who are willing to venture outside familiar disciplinary territory into new spaces for innovation" (Erichsen and Goldenstein, 2011, pp. 8-9).

Collaboration among researchers from different disciplines can be promoted in many ways. Institutions may foster a culture of collaboration by creating an environment that values and rewards teamwork. The other possibility is forming interdisciplinary research teams that include individuals from different disciplines to encourage cross-pollination of ideas. Holding regular meetings of faculty members and researchers to discuss progress, share ideas, and identify areas where collaboration can be improved can be another helpful way. Developing shared goals aligning with the project's overall mission will encourage collaboration and keep everyone focused on the same objectives. Celebrating successes and recognizing team members' contributions is also helpful to foster a sense of accomplishment and teamwork. By following these

steps, institutions can encourage collaboration for interdisciplinary research and improve the chances of success of their research outputs.

Build Facilities and Capacities

Interdisciplinary research requires access to various resources, such as databases, research equipment, and software. In addition, they also need orientation and training to carry out interdisciplinary research successfully. Lyall et al. (2013, pp. 68-69) note, "Researchers with the potential to work across disciplines may need extra encouragement and resources to play an integrative role within an interdisciplinary team. Providing training and additional support to bring people together physically can be especially important when they are from different traditions and disciplines." One way to provide resources for interdisciplinary research is to establish interdisciplinary research centers or institutes. Interdisciplinary research centers will provide a physical space for researchers from different fields to collaborate and share ideas and can also help promote an interdisciplinary research culture. These centers can facilitate sharing resources, equipment, and expertise across disciplines. Another approach will be to provide funding opportunities specifically for interdisciplinary research projects.

The institutions may also think of using technology as a vital link and resource to promote interdisciplinary research, as technology can also play a role in facilitating interdisciplinary research by providing online collaboration tools, data-sharing platforms, and other resources that enable researchers from different fields to work together remotely. Technology can encourage researchers to collaborate and develop innovative solutions to complex problems that may not be solvable through a single discipline. There is also a need to support and prepare early-career researchers for gradual transformation to interdisciplinary research. Bridle et al. (2013) suggest a particular way, 'encounter,' for this purpose, i.e., bringing people from different disciplines together for a few days to learn from and interact with each other. Universities and research institutions can also offer training programs and workshops on interdisciplinary research methods and approaches. These measures will help researchers develop the skills and knowledge necessary to collaborate effectively across disciplines.

Nurture an Interdisciplinary Research Culture

Creating a culture that values interdisciplinary research and encourages collaboration across disciplines is another significant way to foster interdisciplinary research. Concerning interdisciplinary research, culture can be defined as "shared cognitive structures and consensus around culturally correct values, attitudes, and normative behaviors" (Strekalova, 2022, p. 250). Establishing and maintaining a culture that encourages researchers from different disciplines to come together and work for a shared and common goal is a prerequisite for promoting interdisciplinary research. Highlighting what can be an ideal cutlery for prompting interdisciplinary research, Bruhn (1995) notes,

> An ideal culture for interdisciplinary research provides the necessary resources, rewards, and administrative encouragement for scientists to cross boundaries in order to work collaboratively. Perhaps most important in an ideal culture is a belief system that no single discipline has all of the answers to any problem and that no problem is too complex to investigate. (p. 335)

Such a culture can be achieved by fostering relationships between researchers of different fields, organizing cross-disciplinary events and workshops, and promoting the benefits of interdisciplinary research to the broader community. Including interdisciplinary research as a criterion for promotion and tenure and recognizing it through institutional platforms will also create such a culture. Institutions may also encourage researchers from different fields to collaborate and form research teams. Working with faculty members from different disciplines will promote a culture that mainly seems absent in discipline-specific research teams of faculty members from a particular discipline. All these measures, in one way or another, will foster a culture of openness and respect and encourage researchers to have an open mind and respect other disciplines. This openness and respect will create a positive culture fostering interdisciplinary research.

Offer Interdisciplinary Courses

Interdisciplinary courses can be crucial in promoting interdisciplinary research as they bring together students and faculty from diverse fields to collaborate and work towards a common goal. Such courses allow the students to learn by connecting ideas and concepts across different disciplines. Students learning through such courses can apply the knowledge gained in one discipline to another to deepen the learning experience. These courses also enable students to build their interdisciplinary pathway by choosing courses that make sense to them (Weller, 2021).

By exposing students to multiple perspectives and approaches, interdisciplinary courses will encourage them to think critically and creatively and to apply their knowledge and skills in new and innovative ways. Therefore, institutions should develop interdisciplinary courses that expose students to different disciplines and encourage them to think critically about complex issues.

Institutions may move to offering interdisciplinary majors and minors and encouraging faculty to teach interdisciplinary courses. Interdisciplinary courses will allow students to develop skills essential for successful interdisciplinary research, such as effective communication, collaborative problem-solving, and working across disciplinary boundaries. By creating a supportive and inclusive learning environment, interdisciplinary courses will foster community among students and faculty, leading to more meaningful and impactful research collaborations. By offering interdisciplinary courses, universities and institutions can prepare students to undertake interdisciplinary research to drive advances in science, technology, and society and to create a more interconnected and sustainable world.

Promote Communication and Sharing

Effective communication is crucial for the success of interdisciplinary research teams. It helps team members communicate their ideas and research findings to one another, identify common goals, and work together to achieve them. To successfully embark on interdisciplinarity, researchers must be curious, inquisitive, and willing to incorporate perspectives from other disciplines. Therefore, creating space for exchanging and developing communication skills through different mechanisms becomes essential instead of restricting interdisciplinarity to a select group of skilled communicators (Bridle, et. al., 2013). To facilitate effective communication, interdisciplinary research teams can use various tools and methods such as regular team meetings, online collaboration platforms, brainstorming sessions, and project management software. It is also crucial for team members to develop strong interpersonal skills, such as active listening and empathy, to better understand each other's perspectives and work together more effectively.

Additionally, institutions may provide opportunities for researchers to communicate their findings to a broader audience through conferences, seminars, and publications. Communication through such means can bridge the gap between disciplines and create a more integrated research approach. The institutions may also support researchers by organizing workshops, brainstorming sessions, or networking events to share their research ideas or findings with researchers from varied disciplines. These events will help researchers from different disciplines to come together, communicate in common, listen actively, and be open-minded and curious about other perspectives. Institutions may also encourage researchers from different disciplines to attend conferences and seminars outside their field to learn about new research and ideas. Attending events outside their routine habitat can facilitate communication and knowledge sharing between researchers from different fields.

Provide Incentives and Recognition

Instead of apparent needs and benefits, the current academic system fails to promote and recognize interdisciplinary research among faculty and researchers. The existing norms and requirements for promotion and tenure often compel faculty members and researchers to pursue research in their specific disciplines instead of being a part of a research team pursuing interdisciplinary research (Arnold, et. al., 2021). Therefore, particular efforts are required to support and recognize faculty working in emerging interdisciplinary areas. As a way out, Coleman, et. al. (2018. p. 1261) suggest, "Recognition of these faculty in the promotions process through awards and honors, appointments to leadership roles, and advocacy in national forums is essential to career advancement." They also suggest that institutions and leadership may recognize interdisciplinary research through the establishment of awards such as "Collaborator of the Year" or "Innovator of the Year" (Coleman, et. al., 2018, p.1261).

As another measure, funding agencies can grant interdisciplinary research projects to motivate researchers to collaborate across disciplines. Another way to inspire interdisciplinary research is to provide incentives and support for researchers who engage in it. The incentives may be funding, recognition, mentorship, training, or access to resources and facilities. Institutions can offer incentives such as grants, awards, and recognition for interdisciplinary collaborations. They can also provide resources such as shared facilities, travel and conference funding, and interdisciplinary methods training. Institutions can also create platforms and spaces for interdisciplinary exchange, such as seminars, conferences, journals, or online communities, to enhance the quality and impact

of the research outcomes. By providing incentives and support for interdisciplinary research, institutions can help to break down traditional disciplinary silos and promote innovative solutions to complex problems.

Conclusion

Interdisciplinary research is an innovative approach involving experts from various fields collaborating on a joint research project. The primary objective of interdisciplinary research is to address complex problems that a single discipline cannot tackle. This approach aims to provide new insights and knowledge by merging the perspectives of different disciplines. By integrating different approaches and methodologies, interdisciplinary research can create more comprehensive and holistic solutions to complex problems. It also helps promote collaboration and communication across various fields, leading to new research partnerships and opportunities. This approach is essential in advancing scientific discovery by breaking down traditional disciplinary boundaries, encouraging innovation and creativity, and enhancing the relevance and impact of research by addressing real-world issues that cut across multiple disciplines.

Collaboration, resources, interdisciplinary culture, courses, and communication are essential for fostering interdisciplinary research. Funding agencies and institutions need to incentivize and provide resources for collaboration, which can help break down silos and create a more innovative environment. Encouraging open communication, providing training opportunities, and recognizing individuals willing to learn and collaborate across disciplines can also foster a culture promoting interdisciplinary research. Additionally, institutions can provide opportunities for interdisciplinary education, such as courses or programs that expose researchers to different disciplines and methods. It is high time that policymakers, institutions, and educational leadership must come forward and take measures to help build a community of interdisciplinary researchers equipped to tackle complex challenges and discover sustainable solutions for a better world.

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Collaborative Research Networks: Fostering Interdisciplinary Research

Dibyendu Bhattacharyya*

Collaborative Research Networks (CRNs) play an imperative role in fostering interdisciplinary research, providing a framework for diverse fields to converge, exchange ideas, and address complex challenges beyond disciplinary boundaries. It explores the significance of CRNs in advancing interdisciplinary research, examining their key characteristics, benefits, and potential challenges. Interdisciplinary research, defined by the integration of insights and methodologies from multiple disciplines, has become increasingly crucial in addressing contemporary global issues. Collaborative Research Networks serve as dynamic platforms that facilitate cross-disciplinary collaboration, enabling researchers to pool their expertise, perspectives, and resources. CRNs are characterized by their fluid and inclusive structure, allowing scholars to transcend the limitations of traditional disciplinary silos.

In a rapidly evolving academic landscape, CRNs emerge as beacons of collaborative excellence, offering a model for the future of research. By amalgamating the integration of diverse knowledge and methodologies, these networks not only contribute to the advancement of individual fields but also provide a blueprint for addressing the intricate challenges of our interconnected world. The collaborative spirit embodied by CRNs overcoming disciplinary boundaries, paving the way for innovative solutions, shared insights, and a more unified approach to understanding and solving complex problems.

The purpose of CRNs is manifold. Firstly, they stimulate creativity and innovation by encouraging the synthesis of diverse ideas and approaches. Interactions within CRNs often lead to novel perspectives and methodologies that can significantly contribute to solving complex problems.

Secondly, CRNs promote knowledge transfer, fostering a mutual understanding of different disciplinary languages and methodologies. This not only enhances the depth of research but also promotes a more comprehensive understanding of the issues at hand.

Thirdly, CRNs provide a supportive environment for early-career researchers, offering opportunities for mentorship, collaboration, and exposure to a broader intellectual landscape.

Therefore, Collaborative research practices open the possibility of quality research by exploring interdisciplinary fields gaining momentum in its theoretical understanding as well as its pragmatic happening. The basic benefits of CRNs are summarised in Figure 1.

The effectiveness of CRNs is based on certain challenges. One such challenge is the potential for communication barriers between researchers from different disciplines. Effective communication strategies, including the development of a common language and the promotion of active listening, are essential to face this challenge as reflected in NEP-2020 by considering communication skills as one of the essential components for constructing a higher education curriculum.

Moreover, the establishment of CRNs requires institutional support to create incentives for interdisciplinary collaboration, ranging from funding opportunities to tenure and promotion policies that value such endeavors. Collaborative Research Networks stand as catalysts for advancing interdisciplinary research. They embody the occurrence of shared knowledge creation, encouraging researchers to cross the boundary of disciplinary research and work collectively on complex problems.

As the global landscape continues to present multifaceted challenges, CRNs emerge as vital mechanisms for harnessing the collective intellect of diverse scholars, paving the way for innovative solutions.

Interdisciplinary Research: Some Key Points

Interdisciplinary research refers to the

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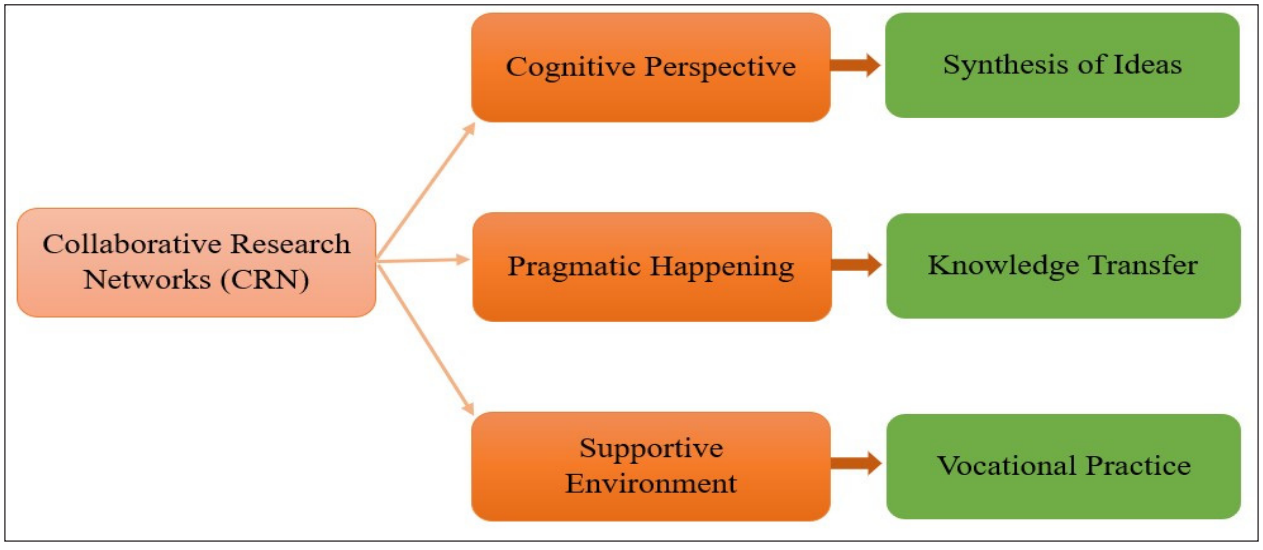
Fig-1: Basic Tenets of Collaborative Research Networks



collaboration and integration of insights, methods, and approaches from multiple academic disciplines to address complex problems or questions that cannot be adequately understood or solved within the confines of a single discipline. It involves breaking down the traditional academic system and fostering cooperation among experts from diverse fields to gain a more comprehensive and holistic understanding of a particular phenomenon or issue. Some of the key points are mentioned below:

***Holistic Understanding*:** Interdisciplinary research enables a more complete and holistic understanding of complex issues by drawing on the strengths of various disciplines. It allows researchers to consider multiple perspectives and factors, contributing to a richer and more nuanced comprehension of the subject matter.

***Addressing Complex Problems*:** Many real-world challenges, such as climate change, public health crises, and sustainable development, are multifaceted and require expertise from different disciplines. Interdisciplinary research provides a framework for tackling these complex problems by bringing together diverse knowledge and methodologies.

Innovation and Creativity: Collaboration across disciplines fosters innovation and creativity. The intersection of different ideas and approaches often leads to the development of novel solutions and insights that may not have been possible within the confines of a single discipline.

***Applicability to Real-world Issues*:** Interdisciplinary research emphasizes the practical application of knowledge to real-world issues. By combining expertise from various fields, researchers can develop solutions that are not only theoretically sound but also applicable and impactful in addressing societal challenges.

Enhanced Research Quality: The integration of diverse perspectives and methodologies can enhance the quality and rigor of research. It encourages researchers to consider alternative explanations, refine methodologies, and engage in more comprehensive analyses, contributing to robust and well-rounded outcomes.

***Cross-disciplinary Collaboration*:** Interdisciplinary research promotes collaboration and communication across disciplinary boundaries. Researchers learn to appreciate and respect the perspectives of others, leading to a more inclusive and cooperative academic environment.

***Training a Versatile Workforce*:** Engaging in interdisciplinary research prepares researchers to work in diverse and dynamic environments. It equips individuals with a broad skill set and the ability to adapt to different challenges, making them valuable contributors in academia, industry, and policymaking.

CRNs serve as dynamic hubs for interdisciplinary collaboration, fostering innovation, knowledge exchange, and the collective pursuit of solutions

to complex challenges. Their characteristics of inclusivity, interdisciplinary focus, flexibility, effective communication, institutional support, and shared goals contribute to their success in advancing collaborative research.

Challenges in Collaborative Research Networks

Collaborative Research Networks (CRNs) serve as catalysts for interdisciplinary collaboration, but they encounter several challenges that can impede their effectiveness. One primary issue revolves around communication barriers among researchers from diverse disciplines. The use of discipline-specific concepts, methodologies, and epistemological frameworks can hinder effective understanding and collaboration. Establishing a common language and fostering open lines of communication are crucial for overcoming this challenge, requiring intentional efforts to bridge gaps and enhance cross-disciplinary dialogue.

Researchers accustomed to distinct disciplinary norms may face challenges in reconciling divergent approaches, potentially impacting the cohesiveness of the collaborative effort. Mitigating these tensions requires a commitment to fostering mutual understanding, respect, and a shared appreciation for the diverse expertise each discipline brings to the table.

Institutional challenges pose significant hurdles for CRNs. Many academic institutions and funding agencies traditionally favor discipline-specific research both in terms of resource allocation and recognition mechanisms. This bias can result in limited financial support and inadequate acknowledgment of interdisciplinary collaborations within CRNs. Overcoming this challenge entails advocating for institutional changes that recognize and value the unique contributions of collaborative, cross-disciplinary research. Shifting funding structures and academic reward systems to accommodate the inherent complexities of interdisciplinary work is crucial for sustaining and encouraging the growth of CRNs.

The dynamic and flexible nature of CRNs, while fostering creativity, may also pose challenges in terms of stability and continuity. Ensuring the long-term sustainability of CRNs requires addressing issues related to leadership, governance, and resource allocation, as well as establishing mechanisms for adapting to evolving research priorities. The challenges faced by CRNs encompass communication barriers, interdisciplinary tensions, institutional biases, and sustainability concerns. Successfully navigating these challenges necessitates a proactive and collaborative approach, involving stakeholders from various disciplines, institutions, and funding bodies to create an environment that values and supports the unique contributions of collaborative interdisciplinary research.

Collaborative Research Networks (CRNs) in Indian Perspectives

In the Indian context, Collaborative Research Networks (CRNs) have gained prominence as vital mechanisms for fostering interdisciplinary research. These networks bring together experts from diverse fields, promoting knowledge exchange and innovative solutions to address complex challenges specific to the Indian landscape. CRNs play a crucial role in leveraging the rich cultural, scientific, and technological diversity in India, facilitating collaborative endeavors that contribute to societal development, sustainable practices, and advancements in various domains. The emphasis on collaborative research aligns with India's commitment

Fig-2: Concepts Propounded by Indian Philosophers and Educationists

Indian Knowledge System	Components of Collaboration
Swami Vivekananda	Synthesis
Sri Aurobindo	Integration
Mahatma Gandhi	Exploring Truth
Rabindranath Thakur	Aesthetic Practices
J. Krishnamurthy	Holistic Understanding
S. Radhakrishnan	Multiplicity of Experience

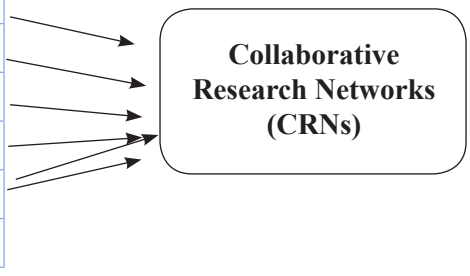


Table 1: Framework of CRNs

Innovation and Creativity →	Synergizing Expertise →	CRNs bring together researchers with varied expertise, fostering innovative thinking and the development of novel ideas and solutions through the intersection of different disciplines.
Interdisciplinary Insights →	Comprehensive Understanding →	Researchers in CRNs contribute diverse perspectives, enabling a more comprehensive understanding of complex issues that span multiple disciplines. This holistic approach can lead to more effective and nuanced solutions.
Knowledge Transfer →	Cross-disciplinary Learning →	CRNs facilitate the exchange of knowledge and methodologies across disciplines, promoting cross-disciplinary learning and enriching the intellectual capital of researchers involved.
Addressing Complex Challenges →	Tackling Multifaceted Problems →	CRNs are well-suited for addressing complex, multifaceted challenges that cannot be adequately tackled within the confines of a single discipline. The collaborative effort allows for a more nuanced and integrated approach to problem-solving.
Resource Optimization →	Pooling Resources →	Collaborative efforts in CRNs often involve the pooling of resources, both human and material. This can lead to more efficient and effective use of resources, enabling researchers to undertake larger and more impactful projects.
Network Development →	Building Professional Relationships →	CRNs provide opportunities for researchers to build professional relationships and networks beyond their own disciplines. This networking can lead to future collaborations, research partnerships, and shared projects.
Enhanced Research Quality →	Diverse Methodological Approaches →	CRNs encourage the integration of diverse methodological approaches, contributing to more robust and well-rounded research outcomes. The inclusion of multiple perspectives helps in avoiding biases inherent in single-discipline research.
Support for Early-Career Researchers →	Mentorship and Collaboration Opportunities →	CRNs often create an environment that supports early-career researchers by providing mentorship from seasoned scholars, collaborative opportunities, and exposure to a broader academic community.
Applicability to Real-World Issues →	Practical Solutions →	Collaborative research often results in solutions that are not only theoretically sound but also practically applicable to real-world issues. This can lead to the development of interventions and policies with a broader impact.
Increased Visibility and Impact →	Dissemination of Findings →	CRNs provide a platform for researchers to disseminate their findings to a wider audience. This increased visibility can enhance the impact of the research, influencing both academic and non-academic communities.

to holistic problem-solving, encouraging researchers to cross disciplinary boundaries for the collective benefit of the nation and beyond. Indian Philosophers and Educationists like Swami Vivekanand, Sri Aurobindo, Mahatma Gandhi, Rabindranath Tagore, J Krishnamurthy, Dr S Radhakrishnan, etc., have propounded various concepts which if adopted, CRNs will be very effective (Figure-2).

Framework of Collaborative Research Networks

Collaborative Research Networks (CRNs) stand as dynamic and essential platforms for fostering interdisciplinary research, embodying the basic theoretical understanding that complex challenges demand multifaceted solutions. The significance of CRNs lies in their ability to break down traditional disciplinary, enabling researchers to make a change that matters in stimulating innovation and creativity by providing a space where diverse perspectives and expertise intersect. Through this collaborative synergy, CRNs contribute to the generation of knowledge that is both holistic and innovative, offering a deeper understanding of complex phenomena by extracting the basic findings of the present paper. The Framework of CRNs is presented in Table -1 for a better understanding of the collaborative practices in Research in a more pragmatic and outcome-based approach for futuristic optimism.

Conclusion

Collaborative Research Networks (CRNs) offer a multitude of benefits, leveraging the collective expertise of researchers from diverse disciplines. The benefits of Collaborative Research Networks extend from fostering innovation and comprehensive understanding to optimizing resources and supporting the development of researchers. These networks contribute significantly to addressing complex challenges and advancing knowledge in a manner that transcends the limitations of individual disciplines.

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Chat GPT : A Game Changer in Research and Higher Education

Karunesh Saxena* and Seema Sharma**

The globe has been captivated by Chat GPT (Generative Pre-Trained Transformer), the Artificial Intelligence (AI) chatbot. Chat GPT is an innovative artificial language model. With the help of it, anyone may communicate with the chatbot in a variety of ways that are human-like. The chat GPT model may help with many things like writing emails, articles, and code as well as providing answers to inquiries (Liu et al., 2021). Regarding Chat-GPT and AI, everyone has an opinion -engineers and businesspeople view it as a new frontier—a brave new world where they may create new goods, services, and solutions. Journalists and social scientists worry about it, calling it an "information warfare machine". Chat GPT has been used for a variety of applications, including customer service, chatbots, and personal assistants. However, one area where Chat GPT can have a significant impact is higher education. This article discusses the potential benefits and some of the significant flaws in the current Chat GPT version. In addition, this article discusses the limitations of using Chat GPT in higher education and explores how it can be used for research purposes. Taking this context into consideration, an endeavor has been undertaken.

- To trace the genesis of Chat GPT
- To discuss the applications in different fields
- To explore the uses of Chat GPT in Higher education
- To discuss the Strengths & Weaknesses of using chat GPT in Education

The Genesis

Open AI, one of the top artificial intelligence (AI) research organizations in the world, created the cutting-edge language model ChatGPT. This research firm was launched by Sam Altman, Elon Musk, Greg Brockman, Ilya Sutskever, and Wojciech Zaremba in 2015 in San Francisco. The first version of ChatGPT, GPT-1, was released in 2018; GPT-2 and GPT-3 followed in 2019 and 2020, respectively. Open AI also launched the most advanced version GPT-4 in 2022. This Open AI lab has made quick strides in the creation of AI technology and made DALL-E and ChatGPT available to the public for machine learning. Early in 2022, DALL-E, a machine learning system that creates innovative graphics depending on user inputs, attracted a great deal of public interest. The most cutting-edge and commonly utilized version to date is GPT-3, with each successive release being an enhancement over the one before it. Chat GPT-3 revolutionized the world by creating 100 million (10 crores) users in just 2 months after the launch. It can comprehend and produce human-like language in a variety of contexts thanks to training on a vast dataset of over 45 terabytes of text.

Chat GPT-What it Entails

Chat GPT uses a method of deep learning, that involves teaching a neural network to learn from a large quantity of data. The Chat GPT neural network is made up of several artificial neuronal layers that cooperate to comprehend the structure and patterns of language. The model learns the patterns and connections between words and phrases by being trained on a big corpus of text data. To enhance the ideas underpinning GPT, a two-stage procedure is used: a) generative unsupervised pre-training using unlabeled data, followed by b) discriminative supervised fine-tuning to boost performance on certain tasks. (Erhan et al., 2010; Budzianowski & Vulić, 2019) In contrast to the fine-tuning phase, which is more supervised and regulated by the authors, the model learns organically during the pre-training phase, much like a human might learn in a new situation. Modern language models created by OpenAI (GPT), Google (BERT), and Microsoft (XLNet) all are state-of-the-art language models and are based on GPT-3 architecture. Large volumes of text may be processed by these models, and they can be trained to excel at tasks requiring natural language processing. Specifically, the GPT-3 model is the biggest language model yet trained with 175 billion parameters. The model

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learns how to carry out tasks using natural language processing and produce content that is well-written and coherent from this text. GPT can be employed to carry out a variety of activities after proper training. Ultimately by using reinforcement learning which is based on human feedback and supervised fine-tuning procedures models are pre-trained to generate appropriate responses. For reinforcement learning, different reward models are created**.**

As it is said that GPT is "transformer" which is based on the transformation process. This process of "Transformation" is a data processing technique done on groups of components, such as words in a phrase or letters in a word. Additionally, "transformers" are machine learning models that have been explicitly created to use transformations to handle sequences of elements. The architecture of the transformers is built on the application of attention, a method that enables the model to focus on certain elements of the input sequence at various points while processing the sequence. This improves the efficiency and accuracy of the transformers' information processing and natural language processing operations. By using this architecture, natural language processing activities may be completed with great efficiency. Following figure 1 shows the architecture of Chat GPT using the transformation process.

Figure-1 is depicting the *"Instruct GPT model"* which has been a standard within Open AI large language models. It optimizes conversational capabilities & improves on top of the existing GPT model. It's all about how Chat GPT works, now in the next section its applications are discussed. By simply using the following steps anyone can easily exceed the chat GPT:-

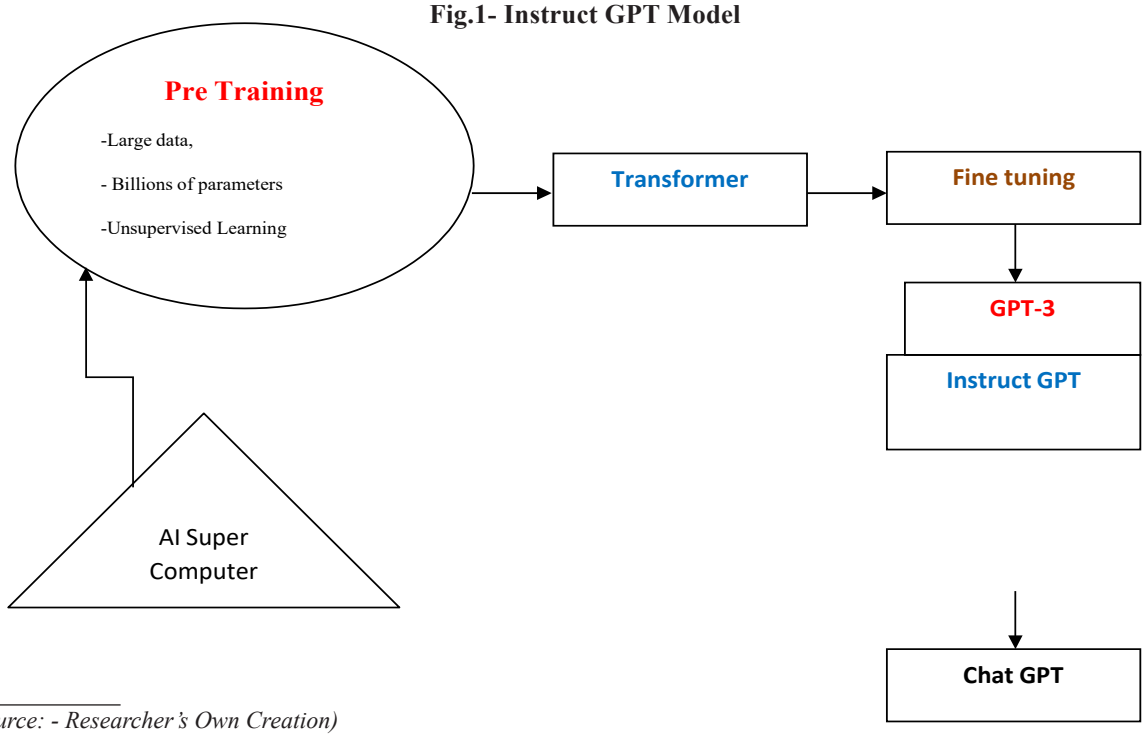
- **Step 1:** - Open the URL *https://openai.com/blog/chatgpt* (in a new window)
- **Step 2**: -Sign up to open an AI account using your email address.
- **Step 3**: -Login to open an AI account.
- **Step 4**: -At the bottom of the screen a type box can be seen on the interface of chat GPT.
- **Step 5**: -Write anything to start chatting with chat GPT.

Thus, by using the above-mentioned steps anyone can easily assess it and can get amazing responses to their queries.

Applications

It has numerous applications in different areas including customer service, education, healthcare, and entertainment. It enables the personalization

Fig.1- Instruct GPT Model



(*Source: - Researcher's Own Creation)*

and responsiveness of customer service offered by chatbots and virtual assistants. Additionally, it may be applied to social media analysis, content development, and language translation.

From Table-1, it is very clear that Chat GPT has maximum applications in the field of higher education. Therefore, an attempt has been made to present the uses of it in higher education. Chat GPT in Higher Education**: -** Chat GPT can be a helpful resource in education in several ways like for students it can assist in homework and research work and can help in improving writing and language skills. It has already gained significant attention in the domain of academia and research very recently. Other ways to utilize it are: -

a) ***Chat GPT as Coder***- It can write codes in different languages in seconds.

b) ***Chat GPT as a Writing Assistant***- GPT can generate coherent and contextually relevant text, making them useful for content generation tasks such as writing articles, blog posts, social media captions, product descriptions, and personalized emails. Chat GPT can assist in automating content creation processes and saving time for content creators.

c) ***Chat GPT as AI Artist***- Chat GPT can assist in generating artistic content, it may not possess the same level of creativity, originality, or aesthetic judgment as human artists. However, it can serve as a valuable tool for ideation, inspiration, and collaboration, pushing the boundaries of artistic expression in conjunction with human creativity.

d) ***Chat GPT as New Google***- Chat GPT can provide information and answer questions based on its pre-trained knowledge. Users can ask questions, seek explanations, or request specific details, and the model will generate responses based on its training data. While it may not have access to real-time information like Google, it can provide relevant and informative responses based on its existing knowledge.

Table 1: - Applications of Chat GPT in Different Domains

Work Area	Application	Technique	Results
Software development	Software testing byevaluating responses of chat GPT to testing questions.	Typed questions relatedto the software testing course	Only 37.5% wereanswered correctly.
Translation	Evaluating the ability ofchat GPT in translating languages	To compare the responses of it, different standardized tests were used.	A good translation of European languages but lags behind on distant languages.
Healthcare	Supporting decisions and improving efficiency in Radiology, Urology, and Ophthalmology	Questions asked related to different diseases and diagnoses and medicine recommendations.	Evaluators found 59.5% accuracy indiagnosis and recommendations.
Scientific research	Writing scientific andacademic papers. Summarizing and translating non-English papers	Discussed differentpapers that used and listed Chat GPT as the author	Logical writing style and speed up research work but has different ethical issues.
Reasoning	Examine the responses of it on different reasoning tests	The proposed framework of multimodal reasoningof different language models.	Performed well on deductive reasoning but not on inductive reasoning
Journalism andmisinformation detection	Evaluate responses of chat GPT on conspiracy statements andmisinformation	Performed a descriptivestudy on responses of it to various COVID-19 vaccine topics	Identified misinformation but dismissive of conspiracy statements.

Source: Adapted from:- Shahriar & Hayawi, 2023

e) ***Chat GPT as an App Developer***- GPT models can be used for creative purposes such as generating poetry, storytelling, scriptwriting, and creating artwork. They can assist artists, writers, and creatives in generating ideas and Social Media content.

To give the readers an idea about how Chat GPT generates the responses, researchers have asked some questions about it and some amazing responses from Chat GPT are quoted in exhibit1 & 2 regarding its use in academia & research.

Here exhibit 1 is showing that the researcher asked to chat GPT about and its use in education and this interesting answer was given. In exhibit 2, researchers asked the second question about ethical issues associated with its use in research, and chat GPT has given a detailed reply mentioning various ethical issues of its use in research. According to Chat GPT responses, researchers can use it to analyze large amounts of text data, such as academic articles and research papers. Chat GPT can also be used to generate synthetic data, which can be used for machine learning and natural language processing research.

By analyzing the responses of Chat GPT it is observed that its responses are very engaging, logical and free of errors. Other strengths of utilizing the chat GPT in education are:-

- ***Time-saving*****:** - Chat GPT provides quick answers to all queries in seconds.
- ***Handling of context & unstructured data***: -It can maintain multiple contexts & can handle large unstructured data at ease as it is trained on a large corpus of text.
- ***Language Correctness*****: -** GPT has an excellent comprehension of the subtleties of human language since it was trained in a big collection of text. This enables it to provide replies that are more like those produced by rule-based systems and that are more natural and human.
- ***Flexibility*****: -** Chat GPT has enormous applications in education like summarizing & paraphrasing text, generating unique ideas for essays, running spell & grammar checks, writing emails & generating practice questions for tests. This implies that it may be used to create a wide range of chat apps, including personal assistants and customer support bots.

Weaknesses

Despite showing numerous interesting &

Exhibit 1- Response to the Author's Question

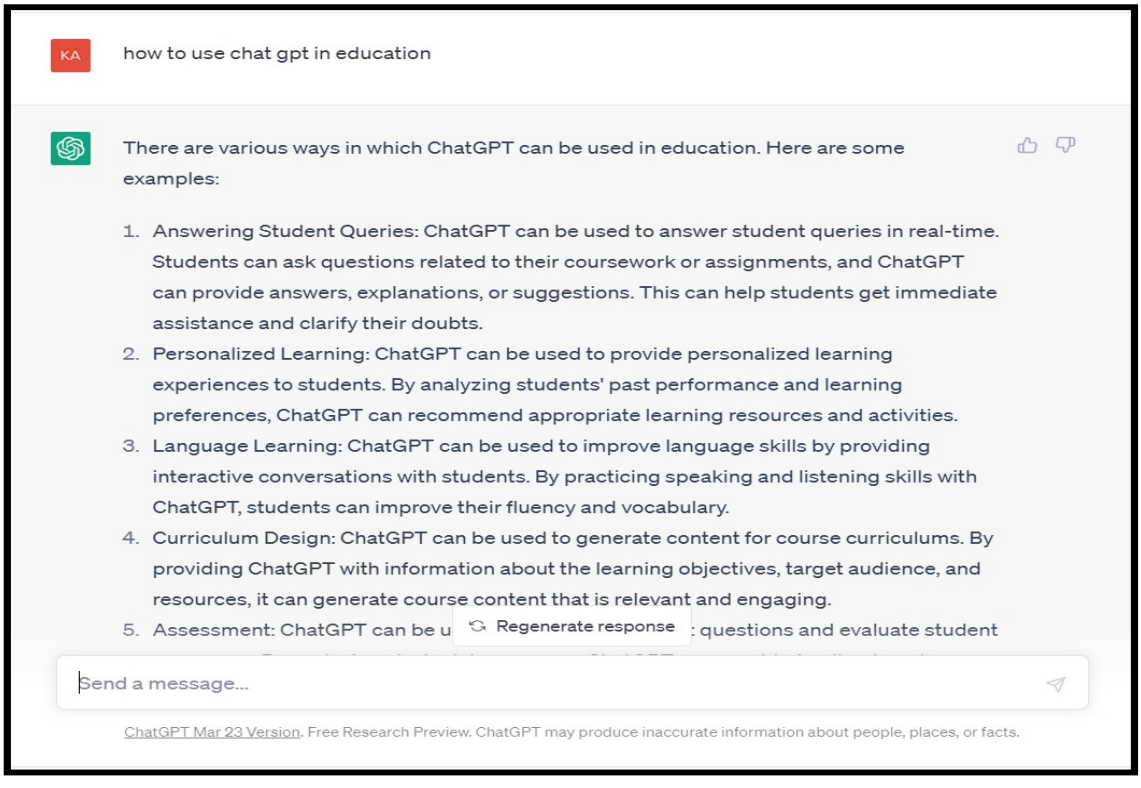
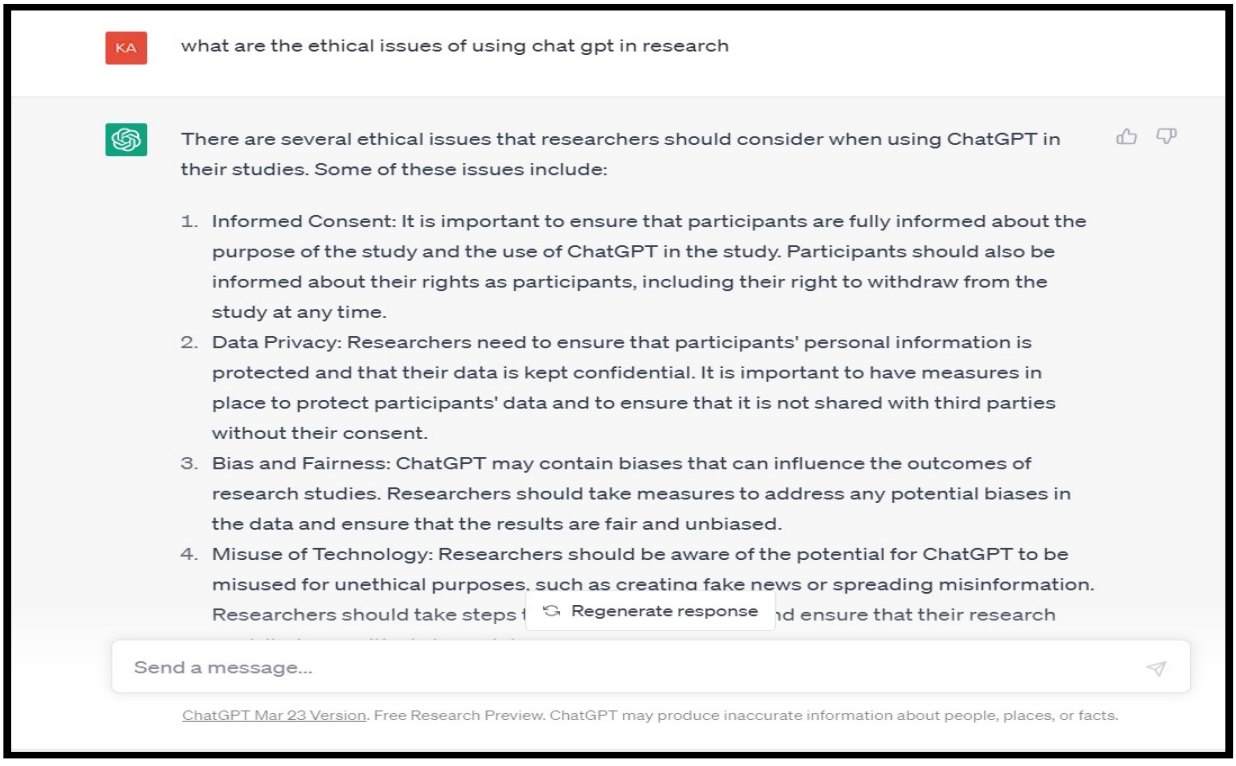


Exhibit 2:-Response to the Author's query regarding its use in Research



convincing abilities, chat GPT also has many limitations. Sometimes it makes errors in simple reasoning & mathematics problems, for instance, it scored 48% in the UPSC exam. A week ago, Live Mint reported in Hindustan Times that chat GPT received a negative score & was able to solve only 11 questions in JEE Advance exam. This shows that there are some concerns about the possible dangers and moral ramifications of employing ChatGPT, as there are with any AI technologies.

- The likelihood of bias in the data used to train the model is one of the main worries since it might lead to biased replies or support negative preconceptions.
- As it is trained on data up to September 2021, so its responses are not so appropriate.
- Furthermore, there is a chance that bad actors may use technology to disseminate false information or carry out damaging actions.
- In addition, it lacks common sense like humans and develops threats to human jobs.
- The most futuristic disadvantage of using chat GPT is the increased dependency of humans on technology which will lead to the deterioration of human intelligence.

Way Forward

In conclusion, due to its numerous features, OpenAI's ChatGPT is swiftly gaining popularity. Chat GPT is a strong and creative AI language model with the potential to transform the way humans communicate and engage with technology. Its powerful natural language processing and synthesis skills have a wide range of practical applications in a variety of sectors. However, it is critical to utilize this technology properly, keeping possible hazards and ethical consequences in mind. In this article, the authors have suggested "Responsible Use of AI-based-Chat GPT" in education. With the help of chat GPT teachers in the present scenario can develop engaging classroom activities to make the teaching-learning process more interesting. All in all, Chat GPT has the potential to transform higher education by providing personalized feedback and support to students, improving accessibility and inclusivity, and creating more engaging and interactive learning experiences. While there are some limitations to using Chat GPT, recent news shows that it is increasingly being used in higher education. Furthermore, Chat GPT can also be used for research purposes, which can have significant implications for the field of natural language processing and machine learning. ❑

Research and Innovation in Project-based Learning

Kalyani Samantray*

This paper aims to discuss the existing research in project-based learning (PBL) and its enormous possibilities for innovation to develop autonomous learning. The research discussed focuses on language learning, particularly second language and foreign language learning, with the PBL transaction processes in the classroom. The innovations deal with developing learners selves through PBL. The discussion includes why innovative and extensive teacher education is essential for the proper implementation of PBL in any curriculum.

PBL for its relevance in the Indian education system has been prioritized by the NEP- 2020, whereby students can access the realities of life and prepare for the challenges they would expect in their career.

The major attention here goes to the review of relevant literature mostly in the Asian context, which has not been attempted in the Indian research scenario to highlight its importance in 21st century learning using PBL. Although the literature reviewed mostly centres round on PBL for second and foreign languages (SL/FL) learning, all the precepts available there are generalizable for application across subject areas taught at different levels of our education system.

Project-based Learning

PBL is a teaching method wherein students acquire knowledge and skills by dedicating either a short duration or a longer period to investigate and respond to engaging and complex questions, problems, or challenges. This defines PBL as a holistic and immersive educational approach. PBL leads students to multifaceted learning outcomes, fostering deep content knowledge alongside the development of their critical thinking, collaboration, creativity, and communication skills. The creative energy of PBL fosters a dynamic and transformative effect on students, which is quite dissimilar to the way they usually get exposed to learning in classrooms.

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PBL stands as an innovative learning process actively engaging each student through the pursuit of real-world, meaningful projects. Its essence lies in students' hands-on involvement in designing, developing, and constructing solutions to authentic problems, often undertaken in small teams. The learning significance of PBL is underscored by its objective to cultivate students' analytical, evaluative, applicational and creative faculties, the highest level of productive learning according to the revised version of Bloom's Taxonomy (Anderson and Krathwohl, 2001).

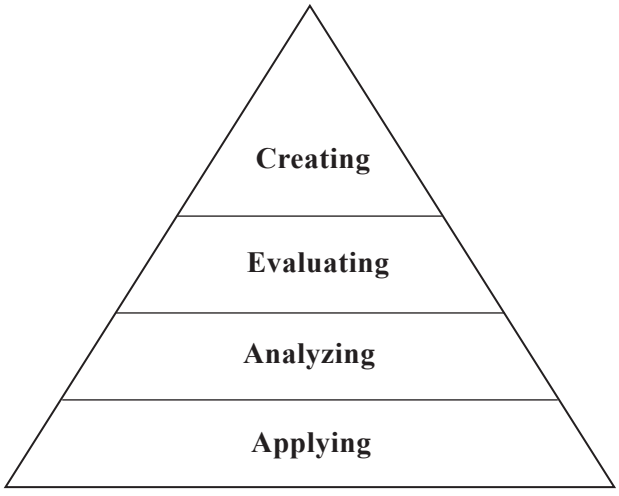
The National Education Policy-2020 emphasizes 'experiential learning' to be adopted at all stages of education across all syllabuses. Learning through PBL includes practical experiences relatable to both syllabus requirements and life situations. This relatability creates value for a student's life from the education they receive, which otherwise remains as bookish knowledge.

Review of PBL Literature

PBL is not a new concept in education. It has emerged in the early 1900s to nurture vocational skills and was later incorporated into other educational streams, including SL/FL learning (Park & Hiver, 2017). Students launch their projects, gather, anayze, and evaluate information, and present what they have learned in oral and/or written format. This student-centered process enables learners to work collaboratively with their peers and use English as a second language/ foreign language (ESL/EFL) communicatively (Hedge, 1993), which results in improved language skills (Stoller, 2006). In addition to its linguistic effects, PBL has the potential to motivate students (Blumenfeld, et al., 1991; Stoller, 2006) from all disciplines. Although the motivational effects of PBL have been investigated (Thomas, 2017), its effects in different educational settings have not been sufficiently examined (Kato, et. al., 2023).

In PBL classes, which reflect Vygotsky's constructivist theory (Daniels, 2001) and Dewey's "learning by doing" conception (Blumenfeld, et. al., 1991), students pursue authentic problems by independently investigating, gathering information,

Fig 1 : Higher Order Skills (Anderson and Krathwohl, 2001)



PBL in NEP-2020

discussing the information, and working collaboratively with peers, and in the end students present outcomes in written formats and/or through oral presentations (Blumenfeld, et. al., 1991; Hedge, 1993; Tanaka, 2023). PBL teachers provide feedback and support students' learning process (Guo, et. al., 2020).

However, Park and Hiver (2017) pointed out that the definitions of PBL in the learning domain vary across studies. They have established three key features that all PBL classes share: i. they are process-oriented, ii. have tangible products at the end, and iii. implement collaborative learning. Previous studies have shown that PBL can positively affect students' motivation (Blumenfeld, et. al., 1991; Kato, et. al., 2023; Park and Hiver, 2017; Stoller, 2006). Despite these facts, very few studies have examined the relationship between PBL and psychological factors of student motivation through PBL (Park and Hiver, 2017).

Motivation is an indispensable element for successful learning, which is defined as "the direction and magnitude of human behaviour, that is the choice of a particular action, the persistence with it, and the effort expended on it" (Ushioda & Dörnyei, 2011, p. 4). Boo et al. (2015) indicate that motivation research is the most required area in language learner psychology. Bailey et al. (2021) claim that intrinsic motivation is more related to students' improved performance in the courses they pursue compared to course-induced extrinsic motivation. Lian et al. (2021) think that authentic language learning may yield learner efficiency through collaborative learning. Phuong (2022) indicates that teachers' in-time support, gamified class content, and interactive activities, such as presentations, can motivate students. Teachers should also consider the possibility of letting students select topics that they want to explore through PBL.

In the L2 Motivational Self System (L2MSS) introduced by Dörnyei (2005), numerous theoretical models have been hypothesized in an attempt to understand complex constructs of motivation. In the L2MSS, as also for any other study area, motivation develops through learners' projection of their future self-images and immediate contextual factors. There can be two self-images that learners think of the 'model learning self' and the 'ought-to learning self'. The former is a positive self that one wishes to become and represents "a desired 'best-case' scenario" (Dörnyei, 2020, p. 123), whereas the latter is a negative self that one thinks they ought to become, which is created by external pressures from significant others, e.g., teachers, friends, parents (Dörnyei, 2009). Filling the discrepancies between one's current and future selves can be a motivator (Al-Hoorie, 2018; Dörnyei and Ushioda, 2013). Another important concept in the L2MSS is the learning experience, which reflects immediate contextual influences on one's mental state. This element is considered crucial because motivation is situated in the natural psychology of humans, and, therefore, some learners are more likely to be motivated by learning environments than by having their future self-images (Dörnyei and Ushioda, 2013). This theory thus concerns how these self-images develop through interaction with complex internal/external processes and experiences (Ushioda & Dörnyei, 2011).

These perspectives are vital to investigating student motivation for goal achievement in PBL application across teaching courses. Park and Hiver (2017) explored the learning anxiety, self-efficacy, ideal self, and self-regulation of thirty-eight Korean EFL secondary students in a seven-week PBL program. The qualitative analysis pointed out that the ideal learning self-developed after the PBL intervention. Tanaka (2023) examined the motivational states of one hundred and eighty Japanese tertiary EFL students from the perspective of their self-constructed, perceived self. The results

indicated that students with interdependent self-construal were more motivated, whereas students with majorly independent self-construal were less motivated in PBL settings.

Kato, et al. (2023) examined the relationship between PBL and motivation of fourteen US students learning Japanese as their L2, and twelve Japanese EFL students. Throughout the semester, they collaboratively created a homepage via Skype using their target languages. Consequently, many of them reported that they enjoyed the PBL programme, learned several useful things, had a great experience, and desired to remain in contact with their partners after their courses were over. This suggests that their motivational aspects were positively influenced. As summarized above, investigations of learners' perceived self in PBL exhibit several positive aspects including motivation for learning and self-improvement.

According to Hedge (1993) and Stoller (2006), features of PBL include the use of a variety of materials, different higher-order skills, teamwork, de-emphasizing teacher-directed work, and promoting students' responsibility in planning, gathering, processing, and reporting of information, resulting in a tangible final product. Stoller (2006) further notes the importance of feedback from peers and teachers, providing students with further opportunities to engage in problem-solving and productive practices at each PBL stage as they move towards their goals. Ultimately, they can conclude the project with evaluation and personal reflections on the process and the product.

Hedge (1993) and Stoller (2006) remark that using authentic materials is associated with positive learning outcomes. Furthermore, Phuong (2022) and Cai and Zhu (2012) add the importance of allowing students to select topics that they want to study through PBL application. They accentuate the use of MOOCs for PBL.

Massive Open Online Courses for PBL

MOOCs, which first began in 2008 (Siemens, 2013), provide students with free higher education-level courses worldwide. Most courses consist of reading materials and lecture videos (Maekawa & Yashima, 2012). Each lecture includes intermittent quizzes or other interactive functions, for example, asynchronous discussion forums, and links to interact with classmates. Students can proceed with learning at their own pace. MOOCs are offered through platforms such as Coursera and EdX. As of 2023, EdX has offered twenty-six fields of study, e.g., business administration, education, science courses, and so on, which further branches into subfields, for example, science courses encompassing eleven subfields, such as biology, chemistry, and cognitive science. When students search for a course they want to learn or use for the PBL, they may select from among introductory, intermediate, and advanced levels that match their background and needs.

Innovative Process of PBL

As a pedagogical approach, PBL encompasses several key processes that typically unfold across distinct phases for learning to happen. The following are short descriptions of these phases.

PBL Phases

Identifying a Problem

Students embark on the PBL journey by identifying problems that pique their interest in the courses they study. Identification can happen either with teacher support or ffrom students' independent choice. The sooner they become independent and move out of the comfort zone of teacher support, the better will be their analysis of the issues, and the better will be their problem-solving abilities. This initial phase lays the foundation for the subsequent steps, encouraging students to explore the nature of the problem and make relevant assumptions.

Devising a Solution

Following the problem identification, students collaborate to hypothesize a solution, and outline the potential path towards its realization. This phase involves critical thinking, evaluation of paths, and final decision-making, as students strategize how to achieve the desired outcome.

Designing and Developing a Prototype

With a solution in mind, students transition to the design and development stage, where they create a tangible prototype. This approach allows them to materialize their ideas, whether through lab experiments, field surveys, mock-ups, storyboards, role-plays, or objects fashioned from available resources.

Refining Based on Feedback

Feedback happens to be a crucial element in the PBL process, with students refining their prototypes based on input from experts, instructors, and peers. Refinement should be iterative to foster a dynamic learning environment, encouraging adaptability and responsiveness to constructive criticism. Thereby, students learn to take into account the value of errors and mistakes in the learning process, and move forward. Teachers also learn to recognize that errors and mistakes are inevitable components of any learning process, and that no learning ever happens if errors and mistakes are not allowed in the process.

Testing

The final phase involves testing the developed solutions in a live or authentic setting. This step provides valuable insights into the functionality of products or services, prompting critical thinking and reflection. If the solution falls short of the anticipated outcome, students analyse what needs reformulating. This promotes a mindset for continuous improvement.

Students may engage in these phases over an extended period, spanning weeks, or even multiple times within single class periods. Project durations can extend from a week to an entire semester, allowing students to immerse themselves in solving real-world problems or addressing complex questions. The culmination of their efforts involves creating a product or making a presentation, showcasing their acquired knowledge and skills.

The flexibility of PBL allows for variations in project size and scope, accommodating diverse syllabus goals.

PBL requires students to traverse disciplinary boundaries thus accessing interdisciplinary information and data to enrich their sensibility and knowledge. They also need to leverage technology for efficient communication and product realization. They have to tackle real-world challenges that external entities can pose for their projects. PBL develops several 21st century skills.

Contrary to the misconception that projects must be highly complex, even quick and simple project endeavours can provide students with valuable opportunities to forge connections across different subjects and apply theoretical knowledge in practical contexts.

Unstructured versus Structured Projects

Research indicates that students derive more significant learning benefits from engaging in unstructured projects compared to highly structured ones. Unstructured projects, often labeled as 'open-ended', lack predetermined solutions, necessitating students to grapple with assumptions, constraints and problem framing unknown to them. This process enhances their ability to transfer learning to diverse problem-solving settings.

Innovative Teacher Role in PBL

PBL holds several opportunities and challenges for a teacher. In implementing PBL, teachers play a transformative role for students in bringing their classroom learning closer to life situations. Educators and administrators unfamiliar with PBL may lack the necessary academic rigor for its seamless integration into their educational systems. Selecting, contemplating, reflecting, and curating potential projects should be an ongoing commitment for teachers. PBL serves as collaborative opportunities for students and educators to refine project questions or problems. While teachers should minimize direct intervention, their role as mentors is crucial, guiding students with expertise and leveraging students' strengths throughout their PBL journey.

Collaboratively selecting an appropriate project marks the beginning of a teacher's role in shaping students' ventures. The most potent tool in the arsenal of teachers for this purpose is the deployment of essential questions. These questions should be open-ended prompts that efficiently serve to initiate, engage, and guide students through the learning process. Over time, students can develop the skill to formulate such questions independently. Collaborative learning is fostered by involving students in listing their inquiries and encouraging them to seek answers from diverse sources and disciplines. Retaining unanswered questions is important as those have the potential to be utilised later. In the robust inquiry process of PBL, students realise their existing knowledge and needs, enabling teachers to construct differentiated learning objectives. PBL transforms the learning process

into more than a daily race to meet lesson plans and course outcomes; it becomes a quest to document the evolving capabilities of students vis-à-vis the course requirements.

In PBL, teachers assess students based on their active participation in and contribution to the project goals, daily achievements and/or progress in the project, and their written and presentation performances. Thus, assessment happens both for the process and the product.

Discussion 1: Existing Research

The advantages of PBL as pointed out in research are i. use of authentic, practical and fresh learning materials, ii. use of MOOCs, iii. use of technology and other learning tools, iv. interdisciplinary approach to problem solving and creativity, v. working in teams, vi. learning to value errors, and use them for self-development, and vii. using both the written format and presentation that enhance multiple 21st century skills.

These advantages create space for autonomous learning and improve motivation. Students notice their learning abilities against challenging materials used, the stimulations they receive from the team, and the impact of peer influences. The application of MOOCs supports independent learning.

Discussion 2: Innovations Foreseen for PBL

Innovations in the Indian context require teacher understanding of two facets of learner development, i.e., i. the Model Learning Self that PBL motivates students to achieve, and ii. the Ought-to Learning Self that students must develop in fulfilling their educational demands.

Model Learning Self

The augmentation of the model learning self is attributed to students learning for their interests through PBL, and participating in practical activities. Students' autonomy over using learning materials positively impacts their motivation, as mentioned by Csizér and Kormos (2014) and Kormos and Csizér (2014), who linked the model learning self with learner autonomy. They suggest a reciprocal relationship between students and teachers to promote autonomous learning that influences motivated behavior, leading to an elevated learner-self. PBL holds the potential for this to materialize (Zheng, et.. al, 2018). Independent learning paths, presentation experiences and meaningful knowledge gained from peers can further solidify students' self-image as future users of skills and knowledge. Aubrey and Philpott (2021) corroborate this, highlighting that students invest more effort when they can relate to topics, situations, and tasks, and are allowed to solve problems and answer questions on their own. This model-self emerges out of intrinsic motivation.

Ought-to-Learn Self

The ought-to-learn self is the normal identity of most students created by externally imposed learning obligations from syllabuses, classroom approaches and examination systems. Such imposition hampers motivation as students are obliged to fulfill the expected external conditions. Ueki and Takeuchi (2013) emphasize that ought-to-learn-self behavior impedes autonomous learning, thereby debilitating critical thinking and problem-solving skills.

Conclusion

PBL should be designed in a manner where students choose what to learn and progress at their own pace inside the demands of the curriculum. This can reduce obligatory feelings towards learning. This requires ample innovations in a practical manner to be successful. Rigorous research in pedagogy and application will support modifying the syllabuses and the examination systems.

However, the most important factor in bringing forth such productive learning as suggested in this paper, and as envisaged in NEP 2020 to prepare students to face life and for career, is teacher attitude, teacher knowledge regarding the factors discussed, and application of these factors in a positive manner both in teaching and assessment.

Research, planning and rigorous execution for intensive teacher education in this area are the essentially required innovations that accrue from the analyses presented in this paper.

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Theory Abundance: Social Science Research at the Crossroads?

K Paddayya*

"... Knowledge so conceived is an ocean of alternatives channelled and subdivided by an ocean of standards. It forces our mind to make imaginative choices and thus makes it grow. It makes our mind capable of choosing, imagining, and criticizing"

(Feyerabend 1999a: 184).

In this article, attention is first drawn to the existence of theoretical perspectives galore in anthropology, linguistics, and other social sciences and the disarray that this theory abundance sometimes causes in the minds of workers while making their own choices. A brief note is then provided about the philosopher of science Paul Feyerabend's sustained critique of the scientific method and theoretical monism. Following his advice to adopt a critical and case study-based approach to the history of science, an attempt is made to evaluate the degree of newness or originality of processual and interpretive archaeologies. Considering the simple fact that any aspect of the empirical world is open to varied interpretations, it is concluded that theoretical pluralism is actually to be welcomed rather than shunned and that theoretical choices are dependent on the nature of actual topics chosen for research. Finally, the article examines the relevance of this debate in the context of Indian archaeology.

The two terms revolutions and paradigms which T.S. Kuhn introduced in 1962 in his influential historiographical work *The Structure of Scientific Revolutions* have now become part of common parlance in both natural and social sciences. While it is true that Margaret Masterman (1972) noted as many as twenty-one different senses or connotations in Kuhn's use of paradigm, Kuhn himself preferred to treat paradigms as "universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners" (Kuhn 1970: viii). For our purposes here we may safely substitute the more commonly employed term theory for paradigm. Theories serve as *Leitmotiven* in different branches of knowledge. Using a metaphor to convey their overwhelming influence on the practioners, Feyerabend compared good theories to "an attractive and yielding courtesan who tries to anticipate every wish of her lover" (Feyerabend 1995: 149). Let us first examine the state of theory formation in social sciences.

Theory Abundance in Social Sciences

With their beginnings tracing back to the seventeenth and eighteenth centuries, physical and biological sciences emerged in their full-fledged forms in the following century. Likewise, all major social sciences made their appearance in their mature forms by the middle of the last century. Each discipline evolved its own basic conceptual framework and set of methodological strategies. Soon theoretical trends crept into each discipline. We now notice that each discipline has not one but many varied theoretical perspectives competing for the attention of workers. We shall briefly consider this theoretical pluralism prevailing in the major social sciences.

The position of linguistics in social sciences has sometimes been compared to that of mathematics in physical sciences. Structural linguistics replaced diachronic (philological and comparative linguistic) studies of the nineteenth century. With Saussure's work serving as the basis, it dominated the discipline from the 1930s to the 1950s. With its foundations rooted in empiricist philosophy, this trend laid emphasis on one-to-one relationship between raw data and theory formation. Inductive generalizations were seen as the final outcome and it was conceded that these would vary from language to language. By the mid-1950s structural linguistics created a self-congratulatory mood in American linguistics.

But very soon this rosy picture was breached by Chomskyan revolution. Chomsky rejected the notion of grammar as the list of generalities extracted from the data universe. Rather he treated grammar as a theory of language, thereby rendering linguistics into a science. Grammar is now viewed as a system of axioms or rules which can generate an infinite

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number of sentences. Thus came into being what is called transformative generative linguistics. Chomsky even hoped to identify a class of basic grammatical processes, i.e. universal grammar, which operate in all languages. These mind-operating processes govern the functioning of language. Chomsky's three books *The Logical Structure of Linguistic Theory* (1955), *Syntactic Structures* (1957) and *Aspects of the Theory of Syntax* (1965) truly ushered in a cognitive revolution in the discipline. Far from remaining as a unitary trend, Chomskyan formal linguistics has undergone transformations of its own since the mid-1970s. These transformations are of two types. Chomsky himself and his associates developed the principles and parameters approach, as represented by the Government Binding theory and Minimalist Program. The second version developed by other workers comprises more than a dozen perspectives which include Lexical–Functional Grammar, Relational Grammar, Generalized Phase Structure Grammar, Head-Driven Phrase Structure Grammar, and Categorical Grammar.

Chomskyan cognitive revolution in linguistics by no means eliminated from the picture the older structural-functional school of thought. On the contrary, this school still not only exists but acts as a fighting rival in the discipline. Here again there are three trends called 'external functionalism', 'integrative functionalism' and 'extreme functionalism', each with its own variety of perspectives. Thus, contemporary linguistics is dominated by two opposing schools of theoretical perspectives, i.e. formal ones which emphasize knowledge of the basic structural aspects of language and functional ones which concentrate on the use or application of that knowledge (for details, see Newmeyer 1980, 1998). The polarity between the two streams seems to have reached a level high enough that calls have been given for "let us talk to each other" (Haspelmath 2000). In fact, as we shall consider later, the picture is vaster and debates in linguistics transcend these two mainstream traditions. There are strong advocates of humanist and sociological perspectives (Newmeyer 1986).

Economics is again a well-developed discipline. Right from ancient times many theories have been put forward as part of general economic thought. These include mercantilist, physiocratic, socialist, historical, and other theories (de Roover *et al.* 1968). Theories of economic growth are equally diverse and range from Marxist theory to technological change models to mathematical theory models (Easterlin 1968). Theory-building in political science again goes back to ancient Greek thought and proliferated in medieval and modern periods. Theories covered theocracy, royalism, nationalism, liberalism, dialectical materialism, communism, and fascism (Sabine 1959). History too has a long history of theory formation (Dray 1964). Commencing with the description of special events and personalities, it passed to the stage of narrative accounts of events and episodes. Various determinist or processual trends built upon the principle of causality came up in the nineteenth century. History writing has been influenced by political, military, psychological, and social factors (Southgate 1996, 2000). We then saw in the last century rise of deconstruction modes of thought which raise objections about assumptions of the past as a referent and the use of narrative for communicating it.

Psychology is another mature social science with a large theoretical framework and an elaborate methodological apparatus. There are different theoretical perspectives cutting across branches such as comparative psychology, physiological psychology, existential psychology, and applied psychology (Waters *et al*. 1968; Marx and Goodson 1976).

Modern sociology began with systems theory, i.e. viewing society as a system, as the first principal theoretical perspective (for a general survey of various theories, see Abraham 1982). With inputs from the work of Henderson, Cannon, Weiner, and von Bertalanffy, general systems theory found footing in sociology since World War II. Studies of society as a system took the form of mechanistic, organismic, and structural models. Functionalism, with its origins going back to the nineteenth century, became a reigning theoretical trend during the third quarter of the last century. Then came up a set of conflict theories, such as those associated with Marx, Dahrendorf, and Horowitz. Exchange theories trace their origins to the ideas of James Frazer and found their modern proponents in George Homans and Lévi-Strauss. Then came up theories of anomic and alienation such as those put forward by Melvin Seeman and Melvin Kohn to account for breakdowns at personal and societal levels resulting from urbanization and industrialization.

Symbolic interactionism arose as another major theoretical trend in the later part of the last century.

The leading idea here was that human interactions are not mechanical or matter-of-fact in nature but are loaded with meanings or symbolic representations. Three schools appeared within this perspective, which are associated Herbert Blumer, Manford Kuhn, and Erving Goffman. To these interpretive approaches, we may add the ones derived from or influenced by Husserl's phenomenological philosophy which focuses attention on ontological issues such as the absolute ground of human knowledge and the identification of essences. The theoretical approaches of Alfred Schutz, Peter Berger, Thomas Luckmann, and Harold Garfinkel's ethnomethodology belong to this category.

The story of anthropology runs more or less similar to that of sociology. It began with simple ideas about man's developmental stages (for general accounts, see Harris 1968; Erickson and Murphy 2003). Banking upon the notices of primitive peoples of other parts of the world made by European explorers of the sixteenth and seventeenth centuries, some of the Enlightenment thinkers began to visualize the trajectory of the human story in terms of the three successive stages of hunting, pastoralism and farming, and civilization. From these informal ideas formal evolutionary perspectives developed in the nineteenth century at the hands of Herbert Spencer, E.B. Tylor, James Frazer, and other workers. Among them, the work of Lewis Morgan is the most elaborate. In *Ancient Society* [1964 (1877)] he postulated the development of human society through the successive stages of savagery (hunters and gatherers), barbarism (plant and animal domestication), and civilization (state-level society), each subdivided into lower, middle and upper stages.

In the early part of the twentieth century, North America, England, and France developed individualistic traditions of anthropological research. North America witnessed the rise of the Boasian school of historical particularism, Kroeber's culture-zone perspective, and psychological anthropology rooted in the works of Ruth Benedict and Margaret Mead. In France, structuralism emerged as the dominant trend under the guidance of Lévi-Strauss. In England, Radcliffe-Brown and Malinowski pioneered functionalist trends. In the later part of the century, anthropological thought experienced fissioning which led to cognitive and symbolic perspectives, cultural materialism, cultural neo-evolutionism, human ethology, sociobiology, feminist anthropology, and transactional. Influences of postmodern thought were also felt through the writings of Michael Foucault, Pierre Bourdieu, and other writers.

Like anthropology and sociology, archaeology too has a long story stretching back to the ancient Latin poet Lucretius's imagination of a distant hunting-gathering stage followed by knowledge of fire, then metals, and, finally, agriculture. Commencing with simple human urges that prevailed in ancient and medieval periods such as respect for ancestors, romanticism, pleasure-seeking, and spirit of adventure, this discipline acquired a true epistemological dimension with C.J. Thomsen's division of the prehistoric past of northern Europe into Stone, Bronze and Iron Ages in the early part of the nineteenth century. Thomsen's Three Age framework initiated what is called culture-history paradigm, i.e. division of the human past into various successive cultural chronological stages, each with its distinctive cultural features and interactions with neighbouring cultures. By the end of the century, this culture-history approach to archaeological records witnessed much elaboration and several sub-stages were recognized within each one of the three ages. Also, archaeology was introduced into the curriculum of some northern European universities. Then the famous excavations of Heinrich Schliemann, Flinders Petrie, Arthur Evans, and other workers brought to light the various Bronze Age civilizations of West Asia and the Mediterranean zone. The rich nature and large variety of cultural material including structures, burials and other elaborate remains facilitated a new knowledge-seeking perspective, viz. reconstruction of total lifeways of different periods. Against this background, several textbook-like publications about method and theory appeared in the market by the middle of the last century (for general surveys of theoretical perspectives in archaeology, see Daniel 1967; Trigger 1989; Johnson 1999; Jones 2002; Paddayya 2014: 1-49).

In its thought and method, the discipline witnessed a revolutionary development in the form of New Archaeology in the third quarter of the last century. Spearheaded by the American archaeologist Lewis Binford and the Cambridge archaeologist David Clarke, New Archaeology rejected trait-list versions of cultures and treated them as systems or totalities. The aim now shifted from objects *per se* to interrelationships among cultural components and between them and those of other cultures and surrounding environmental systems. These

interrelations constitute a cultural process that became synonymous with New Archaeology. Its set of conceptual and methodological strategies included a shift of emphasis from diachronic to synchronic and functional aspects of cultures, adoption of a regional perspective in field studies, employment of middle-range generalizations, and application of the method of hypothesis for tackling problematic issues. Research on the preliterate cultures of North America and Europe benefited in a large way from the employment of processual perspectives. These have also been used in a limited number of cases in Indian prehistory and history.

In the early 1980s, archaeology witnessed a second major revolutionary development in the form of the introduction of interpretive perspectives by Ian Hodder and his colleagues from Cambridge University. Reacting against the hard (functionalist and objectivist) approaches of New Archaeology to it, the archaeological record now began to be viewed by them as a text whose meanings need to be read in terms of human feelings, sentiments, and emotions. This trend commenced with Hodder's ethnographic study of Nuba cattle keepers of East Africa which revealed that material culture items simultaneously serve as symbols in action. In tune with this revised re-conception of the nature of the archaeological record, hermeneutics was introduced as the methodological strategy. Interpretive archaeology emerged as a dominant trend in North European archaeology in the fourth quarter of the last century.

Far from being limited to these two major changes in the discipline, several sub-trends appeared within each during the last half a century. In New Archaeology we have variants such as "explicitly scientific" archaeology, Michael Schiffer's behavioral archaeology, cultural materialism, Marxist archaeology, critical archaeology, evolutionary archaeology, and Annales perspectives. The fission in interpretive archaeology is equally elaborate and we have trends such as Hodder's contextual archaeology, symbolic/semiotic archaeology, hermeneutical archaeology, cognitive archaeology, agency theory, etc. In more recent years, thanks to the inspiration received from phenomenology, a few post-humanist trends have also been introduced, e.g. P-archaeology, speculative realism, new materialism, and object-oriented philosophy. In addition to these epistemological perspectives, trends relating to sociological dimensions of the past have also appeared, e.g. public archaeology, sociopolitics of the past, feminist archaeology, etc.

Since the middle of the last century archaeology has undergone a third major epistemological upheaval. This concerns the increasing use of physical, biological, and earth sciences. Thus we have science-based branches such as geoarchaeology, archaeobotany, archaeochemistry, archaeozoology and biological anthropology. Furthermore, some of these branches have developed within themselves sub-branches. For instance, archaeozoology has divisions called archaeomalacology, archaeoichythology, avian archaeozoology, acaro–archaeozoology, archaeoherpetology, and social archaeozoology.

From this sketch of the development of theoretical perspectives in social sciences, one can extract some general trends. First, the diachronic or long-term trends in the development of human society which helped the disciplines to carve out their individual identities gave way in due course to the need for laying bare the synchronic or short-term trends. Secondly, the earlier conceptions of culture and society as mere dry lists of components have been displaced by a holistic or systemic perspective. This in turn facilitated a processual view calling for the recognition of spheres of interaction (multi-directional) among cultural and non-cultural components. Thirdly, the initial empirical trends which studied cultures and societies in purely functional terms soon began to be replaced by interpretive approaches treating human societies as cognitive and symbolic systems. Then came up phenomenological perspectives emphasizing the need for recognizing the very fundamental or essential characteristics of the creations of both man and nature.

This theory's abundance in social science research is so overwhelming that individual workers often find themselves at a crossroads. In other words, they are confronted with theory choice, i.e. which approach or perspective to adopt for initiating work in their respective research schemes. Their confusion is further confounded by the 'anything goes' views about scientific knowledge advocated by some eminent philosophers and historians of science. Kuhn depicted the normal science stage of research as mere mop-up work or puzzle-solving. New theories are neither aimed at nor tolerated. All work is strictly done within the confines of the prevailing paradigm, encouraging neither the putting forth of new ideas

nor the acquisition of new forms of data. Scientific research is pervaded by herd mentality. Objectivity and creativity which are the characteristics of scientific knowledge fade away into the background (Kuhn 1970: 23-40).

Feyerabend on Science, Scientific Method, and Philosophy of Science

This 'science is not so scientific' view found its staunchest expression in the writings of Paul Feyerabend who made it his career-long pursuit. Feyerabend was one of the towering figures in the twentieth-century philosophy of science. His two books *Against Method* (1975) and *Farewell to Reason* (1999b), because these raised serious arguments against the monopolistic status of science among sources of knowledge, sent alarm bells among scientific circles across the world. Paradoxically, while occupying a senior faculty position in philosophy of science at the Berkeley campus of the University of California for three decades (1958 to 1990), he sought to cut at the roots of this widely popular branch which seeks to examine the what and how of science. Feyerabend's major research papers in this domain published between 1960 and 1980 have been brought together in a three-volume series titled *Philosophical Papers* [1986a (1981); 1986b (1981) and 1999a]. *Killing Time* (1995) and *Conquest of Abundance* (2001) are two other publications of Feyerabend that came out posthumously. His views about the theory of knowledge are briefly dealt with below.

Feyerabend laments that modern-day practioners of science have raised it to the level of a 'church' or an unrivaled way of achieving knowledge about the world (1999a: 200-211). He argues that contemporary studies of the scientific method totally neglect the place of myths, religious beliefs, and common sense knowledge. These forms of knowledge are firmly rooted in experience and as such have their own validity. Here the question is not what is real and what its not real. Rather, as he says, the issue is one of what occurs in which connection and how. Scientific theories also rig experience in their favour and disguise the role of aesthetic, social and irrational factors. Indeed science has become the myth of today just as myth was the science of yesterday. Feyerabend says that distinction between science and myth is itself a myth and asserts that "Science is just one of the many ideologies that propel society, and it should be treated as such". He also denounces the distinction raised by Karl Popper and others between context of discovery and context of justification. Feyerabend also raises objection to reason and objectivity. He writes that till the early part of the last century, "Lady Reason was a beautiful, helpful, though occasionally somewhat overbearing, goddess of research. Today her philosophical suitors (or should we rather say, pimps?) have turned her into a 'mature', i.e. garrulous but toothless old woman" (Feyerabend 1986b: 25). But Feyerabend clarifies that his project is not one of banishing science from the domain of knowledge but reforming it.

Feyerabend has an immense interest in the history of ideas and has great respect for pre-Socratic philosophy, the scientific revolution of the early modern period, and also the nineteenth and early twentieth-century scientists such as Mach, Max Planck, Einstein, and Niels Bohr. But he has scant regard for the new branch called philosophy of science; in fact, he calls it a bastard subject (1999a: 127-137). He says that in the works of Kuhn, Lakatos, and others, the philosophy of science is divorced from the actual body of science itself and its practice. He further says that, while logical positivists were able to keep at bay metaphysis from science, their successors sought to induct sterile formal logic into scientific research. He has scant respect for methodological guidelines or rules laid down by philosophers of science for pursuing scientific research. He accords maximum importance to a detailed study of primary sources dealing with the history of science. In this regard, he considers Ernst Mach's critical historical approach to science as very appropriate because it allows suggestions and criticisms from outside including non-scientific circles such as folk theories.

Feyerabend's final goal is one of going beyond Karl Popper's critical rationalism and other attempts and bringing about further refinements in general empiricist thought. He has reservations about both scientific realism and positivism (Feyerabend 1986a: Chapter I). He rejects scientific realism because it carries with it dogmatic elements, e.g. a) the world is independent of our knowledge-seeking activities; b) science is the surest way of knowing about it; it tells us about the nature of things and also gives predictions. Although positivism does admit some elements of subjectivism, Feyerabend is far from enchanted by its core principles of linking the meanings of theories with experience and the instrumental role of theories. As an alternative, he develops his own version of realism and calls it philosophical realism which provides

for the influence of theories on our observations. Observations are not merely theory-laden but fully theoretical. Philosophical realism further negates the universality of theories. Feyerabend states that older theories may still be useful in the context of presently accepted theories.

Feyerabend is a staunch advocate of pluralism of both methods and ideas (theories). He says that it is the influence of the philosophy of science in the twentieth century which brought in the notion of theoretical monism. He objects to monism because, as he says, it enforces unenlightened conformism and leads to the deterioration of intellectual capabilities and the power of imagination. Feyerabend cites Maxwell, Helmholz, Mach, and other nineteenth-century scientists who argued against theoretical monism and emphasized the need for taking the help of historical sources. He prefers what he calls democratic relativism and further asserts that theories have neither universality nor any permanent validity. Another aspect of science emphasized by Feyerabend is that society should have a role in framing science policies and science should be oriented in terms of the holistic development of society (1999a: 181-191).

This, in short, is the current state of affairs in theory and method in social science research – theoretical perspectives galore in every branch of social science and nagging doubts about the primacy of scientific knowledge and its method. In a way this scenario was only to be expected considering the ever-expanding scope of various disciplines and the large increase in the number of their practitioners since the middle of the twentieth century, leading to 'you frog…you slimy frog' rivalry and quick efforts to niche-carving in respective disciplines. And it is also a fact that we are living in times of post-truth when simple beliefs and opinions are also accorded a place in academic discourse. Inevitably this state of affairs tends to place ordinary workers in a state of perplexity, directionlessness, and uncertainty.Fortunately, there is some relief. For all his virulent attack on science, its method, and theoretical monism, Feyerabend himself shows the way. First, far from trashing them, he wants to reform rationality and science and bring them down from the 'elitist' status they have been accorded till now to "standards which have the advantage of being simple, commensensical and accepted by all" by freeing them from abstract logical criteria imposed on them by philosophers of science (Feyerabend 1999a: 127). Earlier we noted that in Kuhn's normal science objectivity and rationality rather recede into the background and herd mentality governs theory choice. But he too qualifies his observations and says that there are certain standard criteria for evaluating theories. These rules or values include accuracy, consistency, scope, simplicity, and fruitfulness (Kuhn 1977: 322).

It should also be pointed out that Feyerabend's views did not go uncontested by other philosophers of science. In fact, there was a prolonged dialogic correspondence on these topics between him and Imre Lakatos who was a professor of logic at the London School of Economics (Motterlini 1999). In this connection, we may also note that nineteenth-century workers were already familiar with the notion of science as an extension of commonsense. T.H. Huxley, for example, called it organized commonsense. In the early part of the last century John Dewey, representing the American school of pragmatism, elaborated on it in his book *Logic: The Theory of Inquiry* (1938). He wrote: "Scientific subject matter and procedures grow out of the direct problems and methods of common sense, of practical uses, and react into the latter in a way that enormously refines, expands and liberates the contents and the agencies at the level of common sense inquiry" (1938: 66). Surprisingly, Dewey finds but just one single casual mention in Feyerabend's writings (1986a: 46).

Secondly, as is clearly implied in Feyerabend's own statement quoted at the beginning of this paper, theoretical pluralism, far from being treated as a menace, facilitates the growth of knowledge and is therefore to be welcomed (see 1999a: 104-111). Here again, we must note that Feyerabend is not the first person to call for the use of multiple ideas or perspectives in scientific studies. This notion was already known and employed in ancient and modern periods. In ancient Jaina thought it is called *Anekantavada* or multiple versions or theories of Reality. This notion was voiced by several nineteenth-century workers in Europe. We have, for instance, J.S. Mill's famous statement in his essay *On Liberty* (1874) which says that even the opinion of the sole dissenter from the rest of humanity on a particular issue needs to be respected because satisfactory answers to this opinion may actually strengthen the majority view. In 1890 T.C. Chamberlain (1965) wrote a full article on this theme titled "The Method of Multiple Working Hypotheses." In the last century, Karl Popper (1963) advocated the method of

Conjectures and Refutations which also admits the use of multiple approaches.

We thus note that the use of science in a guarded way along with other avenues and the need for the employment of more than one theoretical perspective in the acquisition of knowledge have already been a part of scientific research. The importance of Feyerabend's effort lies in the large number of case studies he has included in his writings to highlight these two aspects of scientific research. I am particularly attracted by his calls for theoretical pluralism and a critical historical approach to knowledge growth. Ignoring the methodological rules laid down by philosophers of science (see 1999a: 138-180), he gives maximum importance to a detailed study of the primary sources themselves dealing with the history of science. He says that there are episodes in the history of science when theories triumphed by suppressing objections and that some continuities may exist between older and newer theories. Noteworthy too is the scope he provides for the role of non-scientists and folk theories. He thus opts not for foundations of knowledge but for knowledge without foundations (1999a: 50-77).

Antecedents to New Archaeology and Interpretive Archaeology

Feyerabend's call for a critical historical approach inspires us to assess the degree of originality or newness of New Archaeology and Interpretive Archaeology because both claimed, at least initially, that they rose upon the death of perspectives that immediately preceded them – ruins of culture-history and other traditional approaches in the case of New Archaeology and the demise of New Archaeology itself in the case of Interpretive Archcaeology. A closer examination reveals several overlappings and continuities between various perspectives. Some of their core conceptions could be identified in the writings of earlier Anglo-American and Asian workers. As mentioned earlier, Thomsen's Three Age System introduced the logos component into modern archaeology and initiated the culture-history paradigm (for elaborate comments, see Paddayya 1993). His detailed grouping of sites and various kinds of objects obtained from them laid the basis for modern classification. His ordering of the objects into three successive ages of stone, bronze, and iron was a reflection of the concept of progress developed by Enlightenment thinkers. Thomsen also laid the basis for the reconstruction of the lifeways approach by asserting that unwritten sources, collectively considered, "give us a clearer perception of the religion, the culture, the external life…of our forefathers … and sometimes awakening and fortifying conjectures as to emigrations and connections of nations …" (1848: 25). These two perspectives were much elaborated upon thanks to the various field discoveries that came up in Europe and West Asia in the next hundred years. Binford does give credit to the contribution made to the discipline by these two approaches but observes that due to the lack of well-defined methodological approaches in their application, these tended to render "reading the archaeological record a shallow and suspicious pastime" (Binford 1982: 84). The writings of Childe and others provided the basic outlines of theory and method in the discipline. It is on these strong foundations that New Archaeology was raised in the 1960s.

There is yet another aspect of the Three Age System which already presaged one of the chief claims to the originality of New Archaeology, viz. hypothesis-making and testing (Paddayya 2016: 321-25). This concept of the Three Ages did not come up in a flash but was developed by Thomsen over a period of two decades. Further, he put it up as a tentative proposition and clearly recognized that its acceptance or rejection would be contingent upon future evidence. His own words are worth repeating: "Our collections are… still too recent and facts too few for the drawing of conclusions with the full degree of confidence in the greatest number of cases. The remarks which we now proceed to offer must therefore be viewed in the *light of conjectures, destined to be confirmed or rectified in proportion as more general attention is devoted to the subject*" (emphasis added) (Thomsen 1848: 63-64). The words conjectures and confirmed/rectified used by him truly capture the essence of the method of hypothesis, as practiced in scientific research. The Three Age system belongs to the category of classificatory hypotheses which, as has been pointed out by the philosopher Copi (1978: 492-7), played a seminal role in the initial stages of development of physical, biological, and social sciences (see also Paddayya 1990: 8-12).

One can cite several other instances of hypothesis testing before the emergence of New Archaeology. Schiffer (2016: 122) has drawn attention to some cases from traditional archaeology in the American Southwest. The hypothesis of correlation between ceramic sequences and tree-ring chronology raised

by A.E. Douglas and his colleagues in archaeology was confirmed by field studies at the site of Show low Ruin. The hypothesis of Harold Gladwin and his colleagues about the existence of various phases in the pre-Colonial period of Hohokam at Snaketown was confirmed by actual excavations. It is also important to note that Walter Taylor viewed hypothesis raising and testing as an integral part of his famous conjunctive approach to the archaeological record. He writes: "… it is a premise of the conjunctive approach that interpretations are both justified and required when once the empirical grounds have been made explicit. Why has revision been made such a bugbear to archaeologists? ... When these are found to demand modification and change they are altered… Why is it not possible to project hypotheses and then go on toward testing and answering the questions thus raised? Why should every archaeological hypothesis have to stand and be correct for all time?" (Taylor 1983: 156).

Robert Braidwood's Iraq Jarmo project concerning the emergence of a food-producing way of life in West Asia also involved hypothesis testing (Braidwood and Howe 1960). Influenced by the idea that the 'hilly flanks of the Fertile Crescent' were a probable nuclear area containing a constellation of potentially domesticable species of wheat and barley and wild sheep, goats, and cattle, Braidwood proposed, as a "reasonable working hypothesis", that the food-producing way of life emerged in this area from a food-gathering stage (Braidwood 1974: 62; see also 1981). He selected the Iraqi Kurdistan area for testing this proposition. His field studies jointly with scientist colleagues and excavations at Jarmo for three seasons (1948, 1950-51, and 1954-55) indeed led to the recognition of an era of incipient food production dated between 9,000 and 7,000 BCE. Braidwood's pioneering work in turn inspired several other projects in other parts of West Asia and the world. Making light of New Archaeology's claims of their originality in the introduction of this topic in archaeology, Braidwood rues: "… If only I had been prescient enough to say *hypothesis* (sic), I could still march with saints, but at least I did say *test* (sic)" (1974: 62).

Indian archaeology too has some interesting examples of hypothesis use from both colonial and post-colonial periods. In his third annual discourse to the Asiatic Society of Calcutta in 1786 Sir William Jones boldly proposed that "The Sanskrit language, whatever be its antiquity, is of wonderful structure, more perfect than the Greek, more copious than the Latin, and more exquisitely refined than either, yet bearing to both of them a stronger affinity, both in the roots of verbs and in the form of grammar than could possibly have been produced by accident, …" (Jones 1807: 34-5). We all know that it is this hypothetical proposition which led to the growth of the very elaborate discipline of Indo-European philology. Another example from a colonial scholarship is provided by James Prinsep's efforts to decipher the Brahmi script which opened up a rich source of information for studying Indian history. Proposing that the last two alphabets which are common to most of the one-line pillar inscriptions of Sanchi probably stand respectively for *dā* and *nam* (meaning, …[of somebody's] donation), Prinsep, in his own words, "became possessed of the whole alphabet, which I tested by applying it to the inscription on the Delhi column" (Prinsep 1837: 461). His inference was influenced by the donative nature of inscriptions he had earlier noticed in the Buddhist temples of Myanmar.

We must also make a reference here to another early and bold attempt at hypothesis-making. This concerns Bal Gangadhar Tilak's theory of the Arctic homeland of the Aryans put forward in his book *The Arctic Home in the Vedas* published in 1903. As advised by Max Müller to supplement his philological, mythological, and astronomical data with scientific evidence, he read deeply into the writings dealing with geography, glacial geology, and prehistoric archaeology and put forward the Arctic homeland theory as "an inquiry conducted on strictly scientific lines". He conceded that his theory will be tested in the light of the results of future research by citing the metaphor that "The fineness or darkness of gold is tested on fire" (Paddayya 2022).

In the post-Independence period, we have two good examples of hypothesis raising and testing in the light of detailed field-based regional archaeological studies; both these studies predate New Archaeology. Led by the various narrative accounts given in the epic Mahabharata and also by the identity of place names in the epic with modern places, B.B. Lal undertook a detailed survey of sites in western Uttar Pradesh and the Punjab region and then excavated for two seasons the mound at Hastinapur (capital of Kauravas) in Meerut district. This excavation exposed remains of the Painted Grey Ware culture sandwiched between

ochre-coloured pottery levels and those of the early historical period. Lal identified this culture with the Pauravas, Panchalas and other early Aryan groups of northern India mentioned in the epic (Lal 1954-55). He called this correlation a provisional answer but no rival interpretation has been put forward so far, leading him now to say confidently that "the Mahabharata was not a figment of imagination. It did have a basis in historical reality…" (Lal 2011: 56).

Raymond Allchin's work on the Neolithic ashmounds of Southern Deccan indeed involved, as he says, "testing the hypothesis we had formed", i.e. interpretation of what was for a century and half summarily dismissed as mere heaps of burnt materials as cattle pens, where cow-dung accumulations were periodically burnt as part of cattle fertility rites. Allchin employed for this purpose archaeological data obtained from both a regional survey and an excavation at Utnur and supplemented with ethnoarchaeological evidence relating to place names, pastoral practices, and folk elements in the Hindu region. He further claimed that these unique Neolithic sites and cattle fertility traditions associated with them "add a new and peculiarly Indian chapter to the history of human institutions" (Allchin 1963: 178).

We noted earlier New Archaeology's reconception of cultures as systemic wholes and their functional or adaptational roles. Here again, the germs of ideas can be found in the writings of many previous writers from both Europe and North America. In his book *Methods and Aims in Archaeology* published in 1904 - probably the first textbook-like account of the methodology of the discipline, Flinders Petrie was already voicing the adaptational aspect of human lifeways. He called archaeology the science "which shows what man has been doing in all ages and *under all conditions* (emphasis added)…" [1972[1904]: vii]. Later Gordon Childe developed this idea more elaborately in some of his writings. For example, in his essay "Changing Methods and Aims in Prehistory" which he delivered as Presidential Address at the Prehistoric Society, London, in 1935, he emphasized the need to rise above the level of typological studies and instead called attention to the treatment of cultures as living, functioning organisms and as adjustments to their respective environments (Childe 1935; see also Trigger 1994; Renfrew 1994). New Archaeology's emphasis on the cultural process or webs of relationships among both cultural and environmental components was already foreshadowed by Grahame Clark by a decade. In his Reckitt memorial lecture delivered at the British Academy in London, he presented this idea in the form of a diagram showing various cultural and environmental components with their linkages represented by multidirectional arrows (Clark 1953).

In North America, John Bennett was one of the first persons who realized that in the 1940s American archaeology was already undergoing a transformation from its historical, fact-gathering stage to that of reflection and generalization (Bennett 1943). He considered arrangements and orderings of data and the development of concepts and generalizations about the data to be important hallmarks of this new phase. He noted the replacement of historical considerations of archaeological records by functional or sociological conceptions as another major facet of this transformation. In addition to the use of concepts such as folk society and culture complex and ethnohistorical data, this functional orientation involved interest in social-economic correlations. In 1948 Walter Taylor published his book *A Study of Archaeology* in which he put forward his conjunctive approach which viewed archaeological remains not as dry-as-dust material but as culture-imbued data encoding past human behaviour (1983). To Taylor archaeology was both history and anthropology—history not in the sense of the sequential ordering of events but as a study tasked with the construction of cultural contexts along the trajectory of time and anthropology because it deals with the nature of culture and cultural dynamics. It is no surprise then that he treated New Archaeology as mere "Old Wine in New Skins" (Taylor 1972).

Commenting on the rise of New Archaeology, the senior American archaeologist Paul Martin was so impressed by its novel features that he called it a revolution of the kind envisaged by Kuhn in natural sciences (Martin 1972). He recognized radical departures from traditional approaches in four major domains of the discipline—reconception of the nature of archaeology as a scientific discipline in the place of its historical connotations; replacement of normative conception of culture by its notion as a systemic whole; introduction of the deductive methodology in the place of inductive or simple data gathering procedures; and rising above pure descriptive studies and attempting explanatory accounts and proposing law-like generalizations.

In the same decade, another American archaeologist David Meltzer came up with a somewhat different interpretation of the place of New Archaeology. He denies that it implies any paradigmatic or revolutionary departure and says that it did not bring any change in the basic metaphysics of the discipline. While conceding that some changes were introduced in general archaeological thought, he argues that these are not one of nature but of degree and incremental in nature. To state the view in his own words: "In short, the changes that took place in the discipline were incremental, not revolutionary. In fact, to deal with these changes one must ignore the Kuhn model altogether since that model only addresses changes of a kind. An alternative, for model-minded archaeologists, would be the linear-continuum model of Thompson… Ultimately, there is very little of the New Archaeology that cannot fit on the same linear continuum with the Old Archaeology… There has been no revolution in archaeology" (Meltzer 1974: 654).

What is this linear-continuum model? Thompson defines a linear model as a simple straight-line providing space to seemingly opposite theoretical perspectives which actually "can be shown to be closely related when compared along the gradations of the scale" (Thompson 1972: 34). He places both traditional archaeology and processual archaeology on this linear scale and concludes that the health of the discipline depends on theoretical pluralism.

Meltzer's detailed argument that New Archaeology marks no departure from but actually forms part of Old Archaeology reminds us of the ten-page introduction in the book *Method and Theory in American Archaeology* which Willey and Phillips (1958: 1-7) published five years before Binford's manifesto-giving essay titled "Archaeology as Anthropology" (Binford 1972: 20-32). This short piece already contains the core conceptions of almost all important conceptual changes advocated by New Archaeology. Willey and Phillips maintain that archaeology, while it may supply raw data for other disciplines, is not only closely allied to anthropology in terms of general theory but actually enriches its scope in spatiotemporal dimensions. In other words, "The archaeologist is in effect a cultural anthropologist". They find close parallels or similarities between archaeology and cultural anthropology at all three levels of scientific study, viz. observation, description and explanation. At the descriptive level, culture-historical studies in archaeology are akin to ethnographic accounts in cultural anthropology. Culture-historical accounts no doubt involve typology, taxonomy, recognition of cultural phases and their functional and environmental contexts, and external relationships in space and time. But all these studies remain at a descriptive level and are geared to getting answers to what questions. At the level of explanation, archaeology seeks *processual interpretation* (sic) which is akin to ethnological accounts of cultural anthropology.

At this level why and how questions are raised and attempts are made to draw generalizations from observations and descriptions which involve causality and transcend time and space. Willey and Phillips recognize a lack of progress in processual interpretation in American archaeology and thus already anticipate New Archaeology's lamentations about traditional archaeology's limitations. In fact, we should note here that the concept of the process has a long tradition in American social science (Kress 1970). New Archaeology's goal of identifying laws of cultural dynamics was clearly anticipated by the statement of Willey and Phillips that "Archaeology, in the service of anthropology, concerns itself necessarily with the nature and position of unique events in space and time but has for its ultimate purpose the discovery of regularities that are in a sense spaceless and timeless" (Willey and Phillips 1958:2).

We shall now consider possible antecedents to post-processual archaeology which has both epistemological and public or sociological dimensions. Here too we need to go back to C.J. Thomsen. Besides his creative epistemological effort in formulating the Three Age system, he was also grappling with or aware of the discipline's public dimension (Paddayya 1993). He expressed happiness that, as compared to the previous two centuries, archaeological sites were receiving better official support and that public interest was also growing about heritage. He took personal interest and led the visitors around the museum galleries every Thursday. He gave special attention to visitors from the countryside because, in his view, "it is by them that we shall have our collections enlarged". It is even reported that he sometimes used to place a golden torc around the neck of a little girl among the visitors in order to enable them to have a feeling of the lifeways of ancient times (Klindt-Jensen 1975: 55).

Flinders Petrie also has something to say in this regard. He already captured the essence of ideational

trends by stating that archaeological remains "reveal man's mind, his thoughts, his tastes and his feelings" [1972[1904]: vii]. Petrie was aware too of the vital role of archaeology in public education and wrote that "… it is best fitted to open the mind and to produce that type of wide interests and toleration which is the highest result of education" (*Ibid*.: viii). Walter Taylor too has more elaborate views and offers a mentalistic definition of culture closely recalling that of interpretive archaeology. While granting that archaeology deals with human behaviour, as objectified in the form of ancient remains, he says that true culture is a mental construct comprising unobservable ideas which generate behaviour. These include attitudes, meanings, sentiments, feelings, values, goals, purposes, interests, knowledge, beliefs, relationships, and associations (Taylor 1983: 101). Willey and Phillips also provide scope for retrieving the symbolic dimensions of human behavior from archaeological records. They state that "Archaeology observes primarily behaviour but has considerable opportunity to observe symbolized behaviour in the forms of art, iconography, and (rarely) written languages …" (1958: 4).

We need to bring Gordon Childe also into the picture here. The writings which he completed in the last decade of his life laid emphasis on the central place of man's cognitive faculty in the functioning and development of human society. We already see in these writings the core formulations of cognitive archaeology. Attention is drawn in particular to his book *Society and Knowledge* (Childe 1956). He called the human species "the sole known society of knowers" (*Ibid*.: 126). Childe treated knowledge as a collective entity that man employs for interacting with the outside world. From a motley of stimuli arising from his interaction with the external world, man captures certain regularities or what Childe calls constructional or intellectual tools (*Ibid*.: 69-95) which provide rules for further action. These intellectual tools are arrived at cooperatively and are used for social action. In *Society and Knowledge* Childe has another interesting chapter titled "Symbols and their Meanings" (1956: 35-43). Here he says that words and characters are symbols and serve as powerful elements in general communication. These statements already presage symbolic archaeology.

Similar calls for recognizing the cognitive dimension of archaeological records came up in North America in the 1970s. Alice and Tom Kehoe reacted against the ecosystem approach that was being advocated by the New Archaeology. They argued that cultural existence has its basis in the cognitive schemata (Kehoe and Kehoe 1973). Robert Hall was another American archaeologist who raised objections to techno-economic determinism and drew attention to the need for understanding the cognitive basis of language, magic, and artistic and literary creations of man (Hall 1977).

India provides clear antecedents to hermeneutics or interpretation which post-processual archaeology explicitly chose as its chief methodological strategy. Known as *tika* (elucidation) and *bhasya* (commentary), hermeneutics has been widely employed in India for pricing out the meanings inherent in ancient writings ranging from Vedic texts to the teachings of medieval saints (Arapura 1986; Sundara Rajan 1991). The writings of Maharashtrian saints Dnyaneshwar and Tukaram, for example, have been interpreted both as a critique of the contemporary social order and as a blueprint for a new order (Sardar 1969).

Even more interesting are the studies devoted to the reconstruction of symbolic meanings of ancient objects and religious monuments (Chandra 1983). E.B. Havell initiated these studies with his exposition of the symbolism of Dhyanibudda image and his emphasis on the need to relate ancient Indian art to the country's religion and thought (1911). Ananda Coomaraswamy, with his vast background knowledge of ancient Indian culture, religion, and philosophy, developed Havell's ideas into a full-fledged interpretive scheme for capturing the symbolic meanings of ancient Indian art and religious monuments (Paddayya 2022: 148-82). While granting the importance of "more mechanical tasks of description" in general art historical studies, Coomaraswamy underscored the need for use of empathy and contextual analysis for arriving at symbolic interpretations. Referring to the Buddha image, he says that " … We are to see, not the likeness made by hands, but its transcendental archetype, we are to take part in a communion… The image is one of Awakened: and for our understanding, who are still asleep. The objective methods of 'science' will not suffice, there can be no understanding without assimilation; to understand is to have been born again" [1986(1938): 147-8]. Likewise, Coomaraswamy interpreted the Hindu temple not merely as an edifice sheltering the image of the god but as the cosmos itself representing in its parts the Indian myth of creation, disintegration, and reintegration. Stella Kramrisch

and other writers pursued further this topic of temple symbolism.

Even more famous is Coomaraswamy's interpretation of the Nataraja dance form of Siva as a symbolic expression of matter in motion and the cosmic cycles of creation, maintenance, destruction, and recreation (Coomaraswamy 1985). This interpretation of the Nataraja dance attracted the attention of physicists and astronomers because it tallies well with Quantum theory's proposition of the erratic movement of subatomic particles (Capra 1991: 269-72). In recognition of this interesting correlation or overlapping of interpretations, a six-foot-tall bronze image of Nataraja, presented by the Government of India, was installed at the entrance of the European Centre for Nuclear Research near Geneva (CERN).

By citing the above antecedents (probably many more exist) to processual and interpretive archaeology, I do not mean to say or imply that there is nothing new or original in these streams of thought. It is only being suggested that the germs of many of their underlying ideas and concepts already lay as isolated notions in the writings of many earlier workers from Europe, North America, and Asia. Although pronouncements of the death of older perspectives were sometimes made by the proponents of both processual and interpretive archaeologies in their first flush of enthusiasm, very soon amends were made and the legacy of ideas from the past was recognized. In fact, the phrase New Archaeology was coined by some of the senior disgruntled workers and daubed on the research schemes initiated by Binford and his associates. Binford was content with calling the changes they had initiated simply new perspectives marking "a major point of evolutionary change". He went further and admitted that "Evolution always builds on what went before…" (1972: 100). Likewise, Hodder recognized the strong foundations supplied by adaptational or functionalist studies of archaeological records to his own interpretive or ideational perspectives (1992: 169-80). He also acknowledged the inspiration provided by the theoretical trends from other social sciences.

In both cases, the newness or originality lay in pooling together ideas that had been loosely spread in time and place and knitting them together to form coherent research perspectives, each with its own set of theoretical and methodological guidelines. In the case of New Archaeology the guidelines included the replacement of the one-site field strategy with a regional approach, the use of sampling and multivariate statistical techniques, and the employment of ethnographic analogies and formation processes perspectives. Many interesting studies of hunting-gathering and food-producing cultures along these new lines have been completed in North America and Europe (e.g. Binford and Binford 1968; Binford 2001; Schiffer 1996; O'Brien, Lyman, and Schiffer 2005; Johnson 2004). And there are calls for the renewal of processual trends (Bell 1994; Kuznar 1997). Similarly, interpretive archaeology's treatment of archaeological records as a text and employment of hermeneutical approaches for recovering mind-expressive components of human behaviour embedded in it has led to some very important studies (e.g. Hodder 1982; 1986).

Thus, in my opinion, the creativity shown by both processual and post-processual trends lies not in introducing into the discipline any totally novel ideas but rather concerns astutely assembling from surrounding disciplines new and useful sets of concepts and methods and shaping these as coherent research paradigms before the slow-moving world of archaeological scholarship. These awakened the workers about the newer knowledge dimensions of the archaeological record. Both processual and post-processual trends thus lowered in their own ways the foundations of archaeology. What Michael Scriven wrote about the legacy of positivism in philosophy is also true in the case of both processual and interpretive trends: "There comes a time in the affairs of science and philosophy when nothing is so valuable as hardheadedness. Positivism brought that hard-headedness to philosophy, and perhaps to some parts of science, at a time when it was needed. Hardheads usually have to be thick heads, and it is no surprise to discover in the cool of later years the issues were not as simple as they then appeared. Nevertheless, revolutions are fought by men who lack finesse, and without them, we would still be in a rather primitive state. We must pay tribute to the revolutionary while avoiding the mistake of deifying his doctrine" (Scriven 1969: 208-9). Processual and interpretive archaeologies richly supplemented rather than supplanted the older perspectives. Whewell was very correct when he wrote nearly two centuries ago: "In the intellectual as in the material world… Nothing which was done earlier was useless or unessential, though it ceases to be conspicuous and primary" [Whewell 1857([1837): 8].

Discussion

We shall now consider the place of Indian archaeology in the context of foregoing observations about theoretical pluralism prevailing in various social sciences, Feyerabend's critique of the monopoly of science and scientific method, and continuities from older to newer research perspectives. The archaeological record in India is one of the richest in the world and has preserved evidence of every phase and stage of the human story from the primitive hunting-gathering way of life to the medieval and colonial periods. Its informal studies commenced more than two hundred years ago and the official archaeological department itself was formed by the colonial government in the early 1860s. A few princely states soon followed suit and then many university departments were set up after independence. In addition to discovery of hundreds of new prehistoric and historical sites across the country, many important excavations have been undertaken during the last seventy-five years.

All these studies were driven by some orientations or the other. To the nineteenth-century interests and urges of adventurism, romanticism, and discovery and description of sites and monuments, the Marshall epoch of the first quarter of the following century added the objective of "recapturing the total culture of India in the past ages" which is best exemplified by the Harappan culture studies of the 1920s. Then in the 1940s came up the Wheelerian concept of building up regional culture sequences or time-tables of cultures. In the 1960s through 1980s versions of processual and post-processual perspectives found clear application in some of the pre-and protohistoric investigations (for a rapid survey, see Paddayya 1995). We have further noted how B.B. Lal's project on the identification of Mahabharata sites, Raymond Allchin's Neolithic ash mounds project and Coomaraswamy's art historical studies were in definite ways already anticipating some of the ideas of processual and subsequent trends.

Thus Indian archaeology is not a total stranger to theoretical pluralism. Feyerabend's statement about alternatives, instead of creating confusion, should help us in making appropriate theoretical choices. In fact, this need for making thoughtful choices from a range of alternatives was emphasized in our own land with a high degree of forcefulness 2500 years ago. I am obviously referring to one of the incidents in the Buddha's peregrinations. Responding to complaints of the rural folk Kalamas of Nalakagrama in upper India that they were puzzled by the varying statements of teachers who had visited them previously, the Buddha told them to exercise their own discretion and then make a choice. He said: "Come, Kalamas, do not be satisfied with hearsay or with tradition or with legendary lore … *When you know in yourselves* 'These ideas are unprofitable, liable to censure, condemned by the wise, being adopted and put into effect they lead to harm and suffering', then you should abandon them… (And conversely) *When you know in yourselves* 'These things are profitable …' then you should practise them and abide in them." (Snelling 1987: 1-3). We should happily note that Indian archaeology, thanks to the rich and varied of nature of the record itself, offers tremendous scope for the employment of various theoretical approaches. I have some suggestions to make in this regard.

1. On more than one occasion I have drawn attention to the fact that archaeologically speaking, 80% of the Indian landscape is still *terra incognita*. We have no knowledge of the nature and chronological contours of the archaeological record of these vast tracts. In such situations, the best way is to initiate survey work as per the guidelines of culture-history perspective. This is the natural history stage in the application of scientific method in inductive sciences and involves much 'looking and seeing', analysis, description, classification, and tabulations of data from the field. These operations facilitate drawing of some empirical generalizations. In our own case, this stage involves detailed field explorations for one or more seasons, leading to the discovery of a number of sites. These may belong to different time periods or cultures. Using type-fossil or typological approach, the identity of each period or culture may be ascertained in terms of some major and other minor components. The issue then is one of verifying the arranged culture sequence by stratigraphic excavations at one or a few places. Thus what Wheeler called a time-table of cultures could be formulated for the area, giving a broad picture of the sequence of cultural stages and their respective diagnostic features (Wheeler 1949). Knowledge of the archaeological record of different areas obtained by these initial surface studies is very helpful in defining the

broad geographical and temporal contours of the country's settlement history. Many of the student dissertations in the universities done at the district or taluk level belong to this category. The matter is one of making them as systematic as possible.

In this connection we must remember that during the tenure of Shri A. Ghosh as the Director General regional circles of the ASI initiated village-to-village surveys of antiquarian remains of all kinds at the district level. This led to the documentation of a vast number of Stone Age, protohistoric and historical sites across the country. This record is very useful for purposes of devoloping local and regional level archaeology. For example, in the Deccan region S.A. Sali, A. Sundara and M.S. Nagaraja Rao used the results of their prolonged explorations in Khandesh region of Maharashtra and Bijapur and Dharwar districts of Karnataka, respectively, for developing elaborate studies of pre- and protohistoric cultures of these areas.

Considering that the landscape in India is undergoing rapid transformation due to the initiation of various developmental projects, there is a need for the revival of these village survey projects by the ASI as well as state and university departments of archaeology. In fact, from time to time some historians and archaeologists have made appeals to the union government to introduce cultural resource management legislation in the country, which will oblige all agencies responsible for developmental projects to take up documentation of antiquarian remains of chosen land patches before actual commencement of developmental works (e.g. Paddayya 1996).

2. Then we have some cases where research endeavors went beyond surface discoveries and culture-sequence establishment and attempted reconstruction of life-ways and processual understanding of individual cultures. A fine example is provided by studies of the Deccan Chalcolithic phase. These represent one of the first field attempts made to fill up the Dark Age or cultural vacuum identified by Wheeler between end of the Harappan culture and beginning of the early historical period. The initial site discoveries belonging to this phase stretch back to the 1950s and were made by H.D. Sankalia, S.A. Sali, M.N. Deshpande and other workers. These early studies were geared toward the identification of a culture-sequence within this phase. The excavations at Nevasa and Daimabad were very helpful from this point of view and revealed a sequence of four cultures dating from about 2000 BCE. to 700 BCE., viz. the Savalda, Late Harappan, Malwa and Jorwe (early and late) cultures. Savalda culture is confined to the Tapi Valley. Daimabad and Nevasa excavations did give some idea of the ceramic and stone tool traditions, burial practices, etc. but the evidence was limited due to the small-size of excavations. So Sankalia keenly desired to find a site fit for a horizontal excavation that alone could expose a full-fledged agropastoral settlement. This is precisely what was achieved by the decade-long (1972-82) excavations at the site of Inamgaon. In other words, Sankalia's aim of reconstruction of lifeways of the Chalcolithic people was fulfilled – settlement layout and nature of houses, copper and stone technology, ceramic traditions, burial practices, plant and animal foods, simple ornaments of clay, bone and other materials, religious practices and belief systems. Professor Dhavalikar, one of the directors of Inamgaon excavation, told me once how Professor Sankalia on one occasion, on seeing the various houses, burials and other features exposed in Inamgaon excavation, was overcome with emotion and literally shed tears of joy.

Surely Inamgaon excavation elevated the information content of the Chalcolithic cultural phases, particularly the Jorwe culture. Still the picture was incomplete inasmuch as the links between the culture and its environmental setting as well as its contacts with adjacent cultures were left unexplored. It is this task which Dhavalikar accomplished in his book *The First Farmers of the Deccan* (1988). For this purpose he adopted New Archaeology's concepts of cultures as systemic wholes and as adaptational mechanisms. Examining the entire Chalcolithic phase in the context of Holocene climatic history, he proposed that the Jorwe cultural phase witnessed a flourishing way of life in the later half of the second millennium B.C. due to a wet climatic phase conducive to agropastoral activity. But, as caused by a drastic reduction in rainfall, the culture declined by about 700 B.C. and assumed a pastoral character specializing in sheep-goat pastoralism. Dhavalikar also made elaborate

comments about regional site distribution as governed by soil factors, intrasite settlement organization, population size, chiefdom level social organization, craft specialization, trade networks, and religious beliefs (see also Sankalia 1977).

3. From the Deccan there are two other instances of the use of processual perspectives adopted from New Archaeology. Both these examples relate to my prolonged field investigations (1965-2001) in Southern Deccan, one dealing with the Acheulian culture of Hunsgi-Baichbal basin in the Shorapur Doab and the second with Neolithic ashmounds of Southern Deccan. The Hunsgi-Baichbal basin covers an area of about 500 km^2; it is an erosional basin lying about 30 km away from the left bank of the Krishna river. My prolonged study of the Acheulian culture of this inland basin involved close, intensive foot-surveys, leading to the discovery of over 200 small and large localities (mostly *in situ* or primary) and excavation of four localities. In contrast to prevailing typo-technological studies of stone tools from secondary sites, my study aimed to investigate this Lower Palaeolithic cultural phase from a settlement system perspective, as advocated by New Archaeology.

   For this purpose, a close study of the spatial spread of sites in the basin was made. This revealed two clusters of sites (one each in the two valleys), each made up of 15 to 20 localities clustered in a stretch of one or two kilometres along the Hunsgi and Baichbal stream courses with spring-fed perennial water flows. The rest of the sites were randomly distributed across the valley floor. Considering the very fragmentary and meagre nature of biological materials from the Acheulian sites themselves, ethnographic surveys were made of the wild animal and plant foods still being exploited by the weaker sections of the population in the basin. These brought to light 50 types of wild plant foods and 35 types of wild animal foods. Based upon these archaeological and ethnographic data sets, it was inferred that the Acheulian settlement system hinged upon two principal seasonal resource management strategies: a) dry-season aggregation of the groups near perennial pools in the major stream courses and reliance on large game hunting; b) wet season dispersal of groups across the valley floor and reliance on plant foods (Paddayya 1982). Further, it was inferred that the population aggregate consisted of eight or nine band-like groups occupying different parts of the valley (Paddayya 2017).

   As argued so cogently by Allchin (1963), ashmounds of Southern Deccan testify to the pastoral character of the Southern Neolithic culture which was well adapted to the area's hilly terrain and semi-arid climate. Allchin grouped Neolithic sites of the area into settlement sites and ashmounds, the latter marking cattle pens. My own regional survey of all major ashmounds in the area revealed human occupation deposits around these mounds resulting from cow-dung burnings. This new evidence raised doubts about Allchin's site grouping and raised the possibility that the ashmounds were not mere cattle pens but regular pastoral settlements. For testing this proposition six seasons of horizontal excavation were undertaken at the site of Budihal (Locality I) in Yadgir district. C^{14} dates prove that this site flourished from about 2000 BCE. to 1400 BCE. The site covers an area of about two hectares in extent. Excavation exposed different sectors of the settlement — a) cattle penning area; b) adjacent to it, cow-dung disposal and burning area; c) human occupation area with dwelling structures, human burials and a large animal butchering floor; and d) a large chert blade-tool workshop. The ashmound itself originally rose to a height of five meters and thus assumed eye-striking monumental proportions. Budihal was a regional center where Neolithic groups from surrounding sites congregated periodically and participated in cattle fertility rites as well as various social and economic transactions (Paddayya 2019: 71-95).

   Besides the Northern Deccan Chalcolithic cultures and the South Indian Neolithic culture, there are ten other early agropastoral (Neolithic-Chalcolithic) cultures known from other parts of the country. The available literature (site reports and research papers) on these sites does give much detailed information about site location and stratigraphy, dating, and ceramics, stone technology and other material culture items. In some cases lists of animals and plants, as revealed by the biological remains from excavations, are also appended. But, in my limited knowledge,

very little effort has been made to investigate these cultures from the point of view of the culture process. In two of my research papers I have drawn attention to the need for rising above this classificatory and cataloguing work and reorienting research efforts in order to recognize the identities of these cultures in terms of their organizational frameworks (Paddayya 2016b, c). This is possible with the adoption of settlement system approach which entails the investigation of these cultures with reference to their respective landscape settings and agroclimatic zones, as recognized by agricultural scientists and climatologists.

I am happy to record here that Julia Shaw has completed an excellent research project of this kind in the early historical archaeology of Sanchi region in Madhya Pradesh (Shaw 2009).

Art and architectural features of the Sanchi site engaged the attention of workers for a century and more. But no effort has been made to understand the whats and whys of the flourishing state of Buddhism in the area, as typified by the Sanchi monument. It is this gap that Shaw has filled up with some remarkable success. Deriving inspiration from British landscape archaeology, she conducted intensive archaeological surveys in the region around Sanchi monuments, measuring about 700 km^2 in extent. These surveys revealed that in the early historical period, the region of Vidisa had a strong economic base, as facilitated by good agriculture and village level tank irrigation created by bunding small streams rising in local hills. It is this economic prosperity that held the key to the flourishing state of Buddhism in the area, as typified by sites like Sanchi, Satdhara, Morel-Khurd and Sonari.

4. Mind-body dichotomy plagued Western philosophy for centuries but it has now finally been laid to rest. Body-enabling and mind-ennobling activities are not separate worlds but are intertwined in ways more than one. Accordingly, it is being increasingly recognized that the research perspectives we adopt for understanding these different spectra of activities need to go in hand (Preucel 1991; Paddayya 2014). The recent archaeological studies from the Deccan region mentioned above simultaneously gave attention to the ideational or mind-expressive aspects of these early farming communities (see Dhavalikar 1988: 37-70). A small female terracotta figurine found in a clay-box in Jorwe culture at Inamagaon has been interpreted as evidence of mother goddess worship. Respect for the dead is revealed in the form of adult and child burials in pits or clay vessels. These burials also reflect status differences, e.g. the burial of an adult male (village chief?) in a sitting position in a four-legged jar within the settlement itself. Also the practice of burying the infants in twin-urns found at this site has been linked to the ancient Indian belief in rebirth.

The Southern Neolithic too has preserved evidence of many adult and child burials. At Tekkalakota a woman (an important person in the society?) was buried in four large horizontally laid urns with several burial pots. At Budihal even infants have been carefully buried in urns. The depiction of cattle and other animals in rock paintings and brusings and on ceramics is an indication that the Neolithic settlers of Southern Deccan had already started appropriating caves and rockshelters, water springs, and animals and plants into their consciousness. This is an antecedent stage to elaborate deifications that came up later. Taking cue from phenomenology-inspired new materialism approaches of recent decades, I have interpreted Neolithic ashmounds from a post-humanist perspective (Paddayya 2021). I have pointed out how the whole chain of events comprising community penning of cattle and cow-dung accumulations; their disposal at a marked spot nearby, their inherent attribute of combustibility and periodic burnings, and resultant ash accumulations leading to mounds of a monumental size have finally led to the emergence of sites like Budihal as regional centres where cattle fertility rites and socio-economic transactions took place. Again, in a recent unpublished study, I have endeavoured to take the study of the Acheulian culture of Hunsgi-Baichbal basin beyond the settlement system perspective and consider it from cognitive archaeology point of view. The cognitive dimension of Acheulian groups who occupied the basin is reflected at different levels: selection of an erosional valley enclosed by hills and tablelands as their habitat; recognition of the seasonality of wild plant and animal foods and surface water sources in

the form of seep-springs; and identification of silicified limestone as a suitable raw material for tool making (Paddayya *In Press*).

Postmodern thought fiercely advanced by Michael Foucault and others and acknowledgment of the importance of post-truth in modern times have added further weightage to the critique of monopolistic trends of science and scientific method and theoretical monism mounted by philosophers of science like Feyerabend. These seemingly negativist opinions or ways of thinking, instead of being construed as the bane of them, need to be considered as a boon to the advancement of scientific knowledge. With some grit, one can always find one's way through the morass of conceptual and methodological uncertainties. From a purely theoretical point of view, any and every aspect of the empirical world, human or natural, is amenable to a variety of soft or hard interpretations. The core issue is not one of truth or falsity of these interpretations; it is one of their contexts of origin and use. All interpretations are contingent upon time and place.

5. While discussing theory use in Indian archaeology, we have noted that the choice of perspectives is dependent on the nature of particular topic or issue was taken up for study — be it just documentation and description of sites, building up culture time-tables and histories, lifeways reconstruction or various perspectives of processualism and interpretive archaeology. These orientations are purely academic in nature and are aimed at building up knowledge of one kind or another about the past from archaeological records. But the relevance of archaeology stretches beyond pure epistemology and covers the humanistic and sociological domains which may be viewed at personal or larger societal levels. Just think of the simple human urges of curiosity, respect for ancestors, dilettantism, romanticism and adventurism with which antiquarian studies commenced some 500 years ago. These urges about heritage are still valid and operate at an individual or personal level (Lowenthal 1985: 35-73). Take, for instance, tourists visiting Ajanta or Taj Mahal and the varied feelings these monuments evoke in their minds. Societal interest in heritage or past may concern group identity, appreciation and toleration of other peoples and other cultures, and feelings of the oneness of humanity. These are themes of axiological nature and seek to recover values embedded in the past and in its study.

In a region like India where the past flows freely into the present, it is impossible to exaggerate the importance of investigating alongside pure epistemological studies the humanistic or psychological and sociological dimensions of the past (Paddayya, 2018). In Britain sociological investigations of how societies remember and use the past have become a regular component of social theory (e.g. Urry 2005). Regrettably, in India such studies are sporadic and isolated. Sucheta Mahajan (2011) has carried out two oral history projects which deal with the narratives of persons who either participated in the freedom movement or suffered the travails of India's partition. Tulika Singh (2020) has completed a doctoral dissertation that tells us about the religious beliefs of school children and their sources and uses. Considering that identity crises of various kinds crop up frequently in our society, there is a clear and urgent need for such sociological investigations to emerge as a major research trend in heritage studies. Thus the task before students of India's past is huge and varied. They have an "ocean of alternatives", to borrow Feyerabend's words, which are complementary. This situation has many benefits attached to it.

As we have noted briefly earlier in this essay, the plurality of perspectives is not less pronounced in anthropology and other social sciences. Here too the humanistic and sociological perspectives hold a place of their own. In a recent essay in linguistics the author has referred to the long-standing chasm between formal (Chomskyan) and functional schools and called upon the younger workers "to closely examine the nature of the contending dichotomous mode of thinking, its influence on the growth of knowledge and ways and means of averting predictable reversals and leading to unhindered advancement of knowledge" (Pandey, *In Press*). But we notice Chomsky himself telling us that "The concerns of traditional and generative grammar are, in a certain sense, complementary…" (1986: 6). A closer look at the theoretical debates shows that the issue is not merely one of clashes

between schools of generative grammar and those of generative semantics (both claiming an autonomous status for the discipline) but it is also one of the challenges posed to both these schools by humanistic and sociological orientations (Newmeyer 1986: Chapter 5). As in the case of archaeology mentioned above, the truth of the matter is that there is no real clash between all these perspectives. Rather, as Newmeyer states, "… it is crucial to stress that there is nothing essentially incompatible about the different *orientations* (sic) to language. The humanist can discuss language as an instrument of creativity and intellectual freedom without abutting the question of its social role or its structure. Likewise, there is no principled incompatibility between the interests of the sociologically oriented linguist and those of the humanist and the grammarian. Why should the study of the social interfere with or detract from that of the aesthetic or the mental? ... the goals of the three orientations are wholly complementary; the field of linguistics can, or should, accommodate each with its unique concern and special contributions to the understanding of language" (Newmeyer 1986: 150).

This tone of theoretical reconciliation pervades other disciplines too. There are psychologists who envision reconciliation between liberalism of radical behavioraism and libertarian ideas of phenomenology (Day 1976). In political theory too, the emphasis is not so much on "patient and dogged application of scientific methods" as on the conception of science "as an imaginative undertaking, with its full share of speculation, playfulness, proclivity to error, and its ability to imagine worlds as yet undreamed of – an ability which would maintain the critical, projective quality that has enabled past theories to speak meaningfully to the quandaries of political existence" (Wolin 1968: 329).

Let me conclude on an amusing note. Our whole concern throughout this essay has been one of accepting the mosaic of theories in the social sciences as a fact and then finding a way or ways of tracking those well suited to one's research topic on hand. It is therefore curious to come across situations where downright antipathy is expressed to the very notion of theory. A senior archaeologist in India treats all talk about theoretical developments in archaeology as mere "appreciative noises" meaning that these need not be treated seriously (Chakrabarti 2001: 1192). From my personal experience, I can also mention that another senior archaeologist likened developments in theoretical perspectives to changes in the shapes of bottoms of men's trousers! We can only take solace in the wise old saying that even the choice of a wrong alternative can eventually lead to some positive outcome while indecisive minds lacking in orientation tend to stay put at the crossroads.

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Knowledge Diplomacy in G-20 Set up: Pathways for India's Way in the Emerging World Order

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When Sir Francis Bacon penned the phrase "knowledge is power" in his book *Meditationes Sacrae* (1597), he probably intended to convey the idea that knowledge is the foundation of reputation and influence, and hence power; all accomplishments flow from it. This statement has never been more apt than in today's global landscape, where nations with strong knowledge and technology domains hold a significant edge over others. As a result, countries are leveraging the power of knowledge to shape their foreign policies and create new instruments for international cooperation. As the world enters a challenging decade witnessing the COVID-19 Pandemic in 2020 followed by the Ukraine-Russia war in 2022 and the Israel-Hamas war in 2023, the ruffling up of the world order has necessitated the adoption of new approaches to diplomacy, with knowledge diplomacy emerging as a potential pathway for *India's way* in the shifting global order. By India's way, India's style of diplomacy with *Vasudhaiva Kutumbakam*, Non-Alignment, and Mutual Respect for other nations.

Aligning neatly with engulfing uncertainties in international governance triggered by the mellowing down of trust in the traditional and formal institutional setup (United Nations, WTO, IMF, etc.) mainly tilted towards developed countries, G-20 has emerged as an array of hope for equitable dialogue and coordinated action towards global challenges. The emergence of G-20 as the main forum for international economic collaboration is related to the ongoing global order transformation as well as the acknowledged need for finding global solutions to issues that are increasingly taking on global dimensions. In light of this, the success of the G-20 has been interpreted as further proof of the growing multipolar order and as a sign of the end of the West's dominance of global politics and economics. However, it has also been seen as a reaction to the growing dependency brought about by globalization. Additionally, its growth has been linked to an ineffective system of international governance.

As India has taken the G-20 presidency in December 2022, the theme being the '*Vashudhaiva Kutumbakam'* which means 'One Earth One Family and One Future', reflects India's way of global cooperation and is a perfect opportunity for India to promote knowledge diplomacy in the G-20 setup. As per Jane Knight, Knowledge Diplomacy is "the use of knowledge as an instrument to achieve diplomatically negotiated objectives while promoting a country's national interests and contributing to positive global outcomes." Traditionally, cultural diplomacy (Gienow-Hecht & Donfried, 2010; Goff, 2013), public diplomacy (Byrne & Hall, 2014), science diplomacy (Ruffini, 2017; Leijten, 2017), education diplomacy (Piros & Koops, 2020), and soft power have been used to analyze the contributions of international higher education. (Yang, 2010; Nye, 2005). However, more recently, and with this article's emphasis, analysis has been conducted using a knowledge diplomacy framework (pioneered by Jane Knight) as opposed to these conventional lenses. This paper therefore aims at exploring the concept of knowledge diplomacy and its potential for India in the G-20 setup during its presidency using descriptive analysis and examining relevant literature.

Knowledge, Power and World Order

The relationship between knowledge and power is well-established in the literature on international relations. Access to and control of knowledge has historically played a crucial role in shaping global power dynamics. Countries with advanced knowledge systems and technologies have been able to gain a competitive advantage over others, thereby enhancing their power in the global arena. Economists like Solow, Williamson, Barro, and Romer have established the impact of research and innovation on economic growth and development. Specifically, Romer's theory of endogenous growth suggests that technological progress can drive sustained economic growth over long periods. This theory highlights the important role that knowledge creation and innovation can play in promoting economic growth and development, which ultimately translates into an increased global power. International higher education has a long history of

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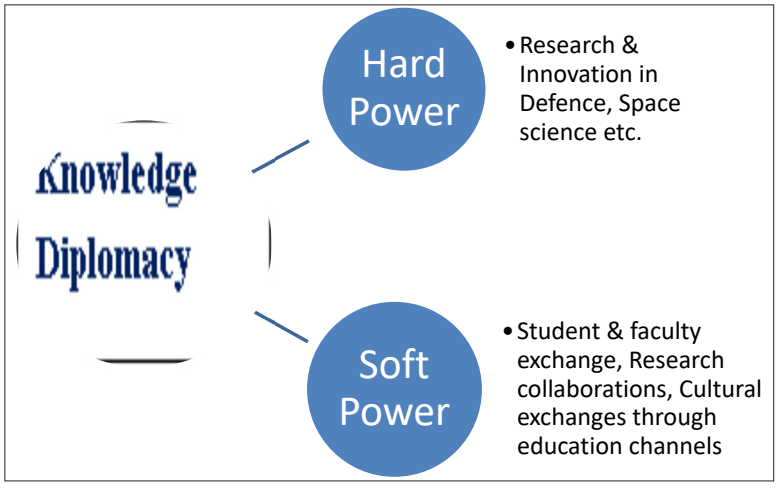
contributing to the strengthening (or deterioration) of relations between and among nations (Knight 2022). Its role is changing as the world confronts new challenges and conflicts. Knowledge diplomacy can influence both the hard and soft power of the countries (fig 1). Due to its significant contribution to developing soft power, knowledge diplomacy is often confused with soft power. However, both are different concepts. Soft power, as defined by Joseph Nye, a well-known American scholar and policy adviser, is "the ability to influence others to get them to want what you want" to achieve dominance and competitive advantage in international relations. Soft power is defined operationally as the use of attraction and persuasion to accomplish national self-interest through co-option and compliance. On the other hand, Knowledge Diplomacy is "the process of strengthening relations between and among countries through international higher education, research, and innovation," It involves a wide variety of state and non-state actors, including universities and colleges, think tanks, foundations, centres of excellence, civil society organizations, private sector research groups, and governmental departments, among others (Knight 2022). However, the close comradery between soft power and knowledge diplomacy doesn't dilute the significance of the contribution of knowledge creation and its diplomatic use in developing hard power. During the Cold War, the United States and the Soviet Union aimed to outdo each other in terms of scientific knowledge and technological advancements to strengthen their global influence and increase their military capabilities. Similarly, China in recent years has increased its focus on advancing its knowledge and technology sectors, recognizing the role it can play in enhancing national power and global influence. On the other hand, India is still struggling to establish itself as a major player in the global knowledge economy, despite its long history of excellence in areas such as mathematics and information technology. This has been attributed to a lack of investment in research and development, limited knowledge dissemination, and weak industry-academia partnerships. This situation is further compounded by an ineffective system of international governance, which does not provide developing countries with adequate opportunities to participate in global knowledge networks and institutions. G 20 setup has the potential to change this as developing countries of G 20 are becoming more vocal and demanding greater inclusion in global decision-making processes.

The COVID-19 pandemic that began in 2020 and the subsequent Russia-Ukraine war in 2022 have disrupted conventional beliefs about international relations and global order. This has emphasized the necessity of research, innovation, and global cooperation to confront unexpected challenges such as a pandemic. The significance of these two events is twofold: first, they illustrate how interconnected global issues are; secondly, they underscore the urgency for innovative solutions to tackle complex problems. Research and innovation have always been crucial elements in shaping a new world order but their relevance has become even more pronounced lately. India has assumed a significant role in combatting the COVID-19 pandemic through its contributions towards vaccine development and extensive production. Additionally, India has strategically positioned itself in the Russia-Ukraine conflict by offering humanitarian aid to Ukraine while maintaining an impartial stance on the matter. Given India's present policies and position, it is imperative to assess its status regarding research and innovation as we transition into a new global paradigm.

Research and innovation are not just mere concepts; they have been at the forefront of shaping human civilization since time immemorial. From scientific discoveries that unravel the mysteries of our existence to technological advancements

Figure 1: Contribution of Knowledge Diplomacy in Fostering Hard and Soft Power



that transform societies, their impact on global power dynamics cannot be overstated. The age of exploration stands as a testament to this claim with nations like Spain, Portugal, and England employing advanced navigational tools and ships to assert their dominance over maritime trade routes leading them towards gaining an undeniable stronghold in world affairs. Similarly, during the Industrial Revolution when humanity saw unprecedented progress through machinery and new methods of production, countries such as the United States leveraged these developments for economic growth thereby attaining unparalleled supremacy in international politics. It is without any doubt that research-driven innovations continue to play a critical role in molding contemporary society while influencing prospects. Throughout the Cold War era, nuclear research and innovation were at the forefront of global discussions due to their direct impact on international relations. As nations raced to increase their military might, new developments in technology were leveraged as a means for gaining strategic advantages over one another. The resulting arms race had profound implications that would shape global politics for decades. Although the role of research and innovation continued to be significant after the end of the Cold War, its contribution towards shaping world order took on a different form. Instead of solely contributing towards military might like before, innovative ideas became instrumental in driving economic growth through production scaling and globalization - both key tenets under neoliberalism ideology. Amidst this paradigm shift stood China which strategically invested heavily into its own research and development initiatives while concurrently crafting diplomatic policies aimed at fostering robust trade relationships with other nations worldwide. This approach paid off immensely as China soon emerged as an economic superpower; able to leverage its newfound strength not only regionally but also globally largely in part thanks to its focus on research-driven innovations.

In the past few years, India has made remarkable progress in terms of research and innovation. With its growing expertise in software development, IT services, and biosciences, India has emerged as a prominent player on the global stage. However, despite such significant accomplishments, it is disheartening to note that India's expenditure towards research and innovation is less than one percent of its GDP, which pales in comparison to the USA or China. India is considered an emerging economy with immense potential for growth opportunities across multiple sectors globally; however, owing to minimal investment within R&D activities translates into weaker contributions toward overall progress through scientific discoveries etcetera from Indian shores when compared to nations investing more heavily. It goes without saying that research infrastructure remains one of the biggest challenges facing India today - this coupled with inadequate funding makes matters worse especially since these two aspects go hand-in-hand. Additionally finding ways for better collaboration between industries and academic institutions continues to be problematic thereby slowing down advancements that would otherwise have been achieved collaboratively rather easily Therefore, it is imperative for India to make further investments in research and innovation to realize its full potential and become a global player on the international stage.

India is sitting on the demographic gold mine with a large and educated workforce that can be leveraged to drive research and innovation and India is blessed with a strategic geographic location. However, if India fails to prioritize research and innovation, the country risks falling behind its global competitors in terms of economic growth and geopolitical power. India must formulate comprehensive policies that promote research and innovation across all sectors, provide funding for high-risk projects with potential breakthroughs, strengthen industry-academic partnerships and collaboration, and invest in research infrastructure to create a conducive environment for innovation. As India overtakes China as the most populous country in the world, its immense potential lies in its demographic dividend - a large and educated workforce that can be harnessed to fuel research and innovation. Furthermore, India's strategic geographic location provides unique opportunities for the country to become a global player on the international stage. However, merely recognizing this potential is not enough; India must prioritize investments in research and innovation to realize it fully. The consequences of failing to do so are dire- falling behind global competitors in terms of economic growth and geopolitical power. Therefore, comprehensive policies promoting research across all sectors must be formulated with funding allocated towards high-risk projects with breakthrough potential. Industry-academic partnerships and collaborations should also be strengthened as they provide fertile ground for

innovative solutions to complex problems facing our world today. Lastly, investing heavily in creating an enabling environment will lead us one step closer to realizing our full innovative capacity by developing cutting-edge infrastructure capable of supporting revolutionary ideas that address some most pressing challenges we face globally such as climate change or public health crises like COVID-19 pandemic. To sum up, India's success as a global player on the international stage hinges on its ability to prioritize research and innovation.

Evolution of the Concept of Knowledge Diplomacy

The new world of diplomacy is characterised by the transition from a state-based approach, which is usually focused on the Ministry of Foreign Affairs and professional ambassadors, to a multi-actor approach (Hocking et al., 2012). Along with a wide range of government organizations, such as institutions of higher learning and science and technology agencies, civil society organizations, multinational corporations, and professional networks have also emerged as significant actors in diplomatic relations. (Pigman, 2010). The variety of state and non-state education actors actively involved in international relations includes national and regional associations, universities and colleges, research centers, disciplinary groups, expert networks, foundations, and governmental agencies, to name a few. (Knight, 2015). Knight recently put forth the following definition of knowledge diplomacy: "the process of establishing and fostering international relations through higher education, research, and innovation." (Knight, 2021). In this definition, diplomacy is purposefully presented as a procedure—a sequence of steps taken to achieve a goal. This definition of knowledge diplomacy is in line with the idea that broadly speaking (Griffiths et al., 2014), diplomacy is the process of building relationships between and among nations to operationalize foreign policies. Knowledge diplomacy, then, is a foreign policy tool that leverages the soft power assets of education and science to address global challenges in collaboration with other nations and to promote international understanding and cooperation. Issues discussed in G-20 under the Presidencies of the Various G-20 Countries which contributed to the evolution of Knowledge Diplomacy are presented in Table 1.

Before 2018, the G20 primarily focused on financial and economic issues, such as combating tax evasion, regulating global banking, and addressing issues like sovereign debt, among others. Between 2008 and 2017, the G20 developed as a key forum for discussing global economic issues, but the potential of educational and research cooperation as tools for international diplomacy was not explicitly considered.

It was under Argentina's presidency in 2018, that the discourse began to shift with the addition of the education working group. A focus on financing education and skills systems was also initiated, marking a significant shift in the topics traditionally broached at the G20. It suggested a growing acknowledgment of education's role as not just a sector of internal policy but also as an area of international cooperation and diplomacy.

Following this, Saudi Arabia, Italy, and Indonesia continued to incorporate aspects of 'Knowledge Diplomacy' in their respective presidencies. This indicates a growing trend within the G20 to address education and research topics, signalling the international acknowledgment of knowledge as a valuable asset and negotiation point on the diplomatic stage.

Under India's presidency, these efforts have even been amplified, further emphasizing the importance and recognition of 'Knowledge Diplomacy' within the G20 framework. This historic shift and the greater emphasis on educational themes represent an important evolution in the approach and scope of the G20 forum.

Scope of IHERI as Knowledge Diplomacy Tools by India in G-20 Set Up

Student Flow-based

The student-based approach to knowledge diplomacy emphasizes the critical role students play in international relations as ambassadors of their home countries, facilitators of intercultural dialogue, and future global leaders. This concept is often highlighted in the context of international student mobility, which leads to the transfer and exchange of knowledge, skills, values, and perspectives across borders. In G20 discussions, this student-based approach would spotlight the importance of inflows and outflows of international students among the countries. For instance, facilitating student exchanges, promoting scholarships for overseas study, and recognizing foreign qualifications can contribute to

Table 1: Issues Discussed in G-20 under the Presidencies of the Various G-20 Countries: Scope for Knowledge Diplomacy

Year	Chair	Major Points of Discussion	Educational & Research Cooperation	Theme
2008	USA	Efforts to tackle tax evasion and avoidance ; controls on hedge funds and rating agencies ; Financial Stability Board (FSB) ;	✖	NA
2009	UK	established the G20 as a major decision-making body on matters relating to the global economy ; regulations for the banking sector	✖	NA
2010	Canada	Sovereign debt; Basel III Norms; reform of the financial stakes and voting shares in the International Monetary Fund (IMF).	✖	NA
2011	France	Reform of the international monetary system; Agricultural Market Information System; international policy coordination in times of crisis.	✖	NA
2012	Mexico	Fighting youth unemployment and creating quality jobs with social security coverage and fair income, link between the development agenda, agriculture and green growth.	✖	NA
2013	Russia	Tax evasion and avoidance ; Action Plan on Base Erosion and Profit Shifting (BEPS)	✖	NA
2014	Australia	Increasing collective GDP by an additional two percent; Common Reporting Standard for Automatic Exchange of Tax Information; 'Brisbane 25 by 25' goal, which aimed at reducing the gender, gap in the labour workforce by 25 percent by 2025.	✖	NA
2015	Turkey	Looked for the first time at migration and refugee movement; financial sector reforms; resolved to support the global climate agreement; Fight against Terrorism.	✖	"Inclusiveness, Investment, and Implementation".
2016	China	linking sustainable growth and social welfare ; Digital Economy as an important driver of development and growth became part of the G20 agenda for the first time ; 'G20 Action Plan on 2030 Agenda for Sustainable Development	✖	Toward an Innovative, Invigorated, Interconnected and Inclusive World Economy
2017	Germany	Global menace of terrorism; The "irreversibility" of the Paris Agreement; Aligning policies with the 2030 Agenda for Sustainable Development and the Addis Ababa Action Agenda on Financing for Development ; G20 Compact with Africa	✖	Shaping an interconnected world
2018	Argentina	Future of work; Fourth Industrial Revolution, Health, Youth, Infrastructure for development; and Sustainable food security	Education Working Group, financing of education and skills system, future of skills, governance of education	Building Consensus For Equitable And Sustainable Development

Year	Chair	Major Points of Discussion	Educational & Research Cooperation	Theme
2019	Japan	Trade and Investment; Digitalization; Data Free Flow with Trust; G20/OECD Framework on Base Erosion and Profit Sharing; Quality Infrastructure investment; Anti-Corruption; Climate Change; Energy; Environment; Displacement and Migration.		"Global Economy", "Trade and Investment", "Innovation", "Environment and Energy", "Employment", "Women's Empowerment", "Development" and "Health
2020	Saudi Arabia	Commitment to fight the pandemic; Safeguarding the global economy; Addressing international trade disruptions Enhancing global cooperation to counter the pandemic's impact.	Early Childhood Education, use of digital tech in early childhood education	Realising Opportunities of the 21st Century for all
2021	Italy	Recovery from pandemic and global health governance; Economic Recovery and resilience ; Climate change ; Sustainable development and food security	Hosted education ministries with joint segment with labour ministries	People, Planet, Prosperity
2022	Indonesia	Global health architecture ; Sustainable energy transfer ; Digital transformation	International collaboration to develop digital skills and literacy	Recover Together, Recover Stronger
2023	India	Africa's G-20 membership, New Delhi Leader's declaration to promote inclusive growth, India-Middle East-Europe-ISA corridor, Global bio-fuel alliance	Make education more inclusive and equitable, delivering quality education, bridging the digital divide in learning, promoting scientific cooperation and facilitating life-long learning	Vasudhaiva Kutumbakam: One Earth, One Family, One Future

Global North-South and South-South cooperation. This approach, while fostering greater cultural understanding and peace, also links to economic factors. International students contribute to the host country's economy and, upon returning home, apply and share the knowledge and skills acquired abroad. This brain circulation can create win-win situations for the countries involved, fostering economic growth and development. In summary, the student-based approach to knowledge diplomacy involves the strategic use of international higher education for diplomatic objectives, promoting not only the national interests of the countries involved but also contributing to positive global outcomes.

In the G20 setup, significant international student mobility is observed, with Australia leading in inbound student mobility rates, followed by the UK, Canada, Germany, and France(Fig-2). (Fig-2). (Fig-2). (Fig-2). (Fig-2). (Fig-2). (Fig-2). (Fig-2). (Fig-2).. These nations receive a significant percentage of inbound students contributing to the global educational diversity. In terms of individual countries' contribution, India, which has seen a

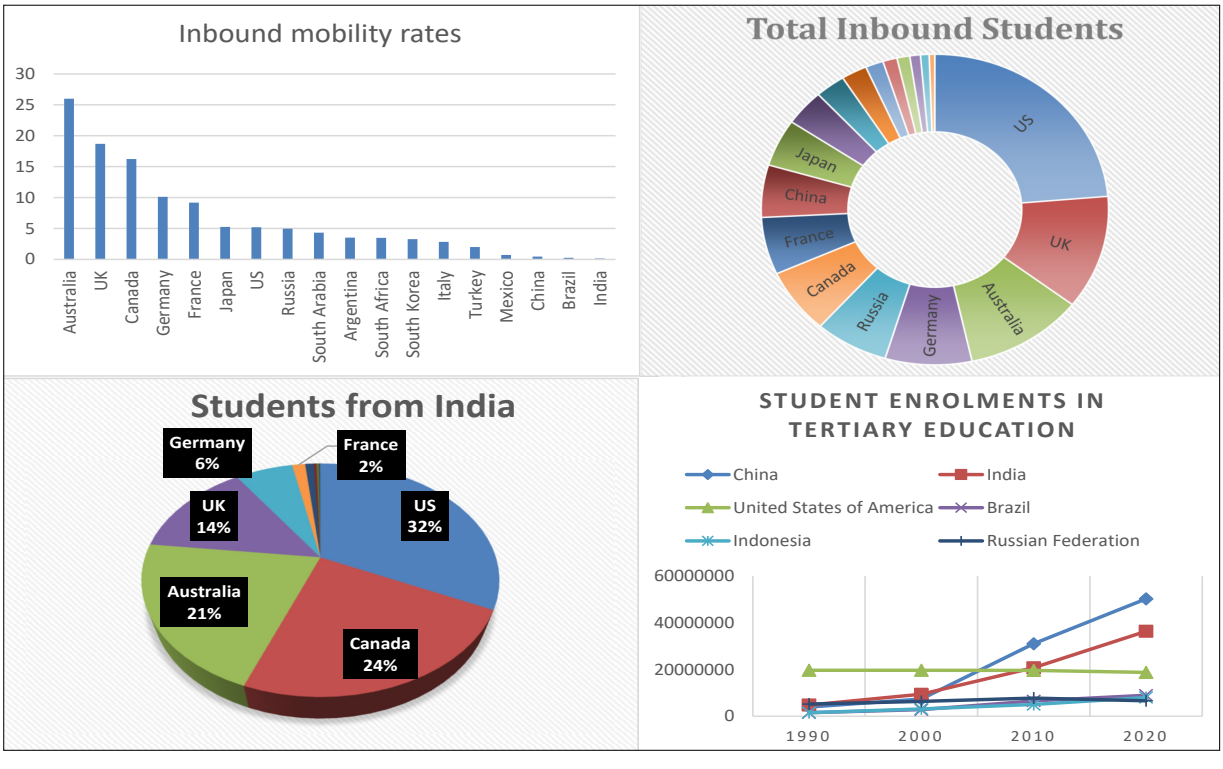
substantial increase in tertiary education enrollments post-2000, sends 32% of its total students to the US, followed by Canada (24%) and Australia (21%). This illustrates the trend of Indian students seeking higher education opportunities in these countries. Regarding student enrolment in tertiary education, China and India, two of the most populous nations, have seen a significant rise in tertiary enrollments since 2000, with large numbers of these students seeking education in Western countries. However, this trend coincides with a decline in tertiary enrollments in the USA. Taking these figures into account, the student-based approach to knowledge diplomacy can prove highly beneficial for India. By sending students abroad, India is not only investing in its human capital but also strengthening bilateral ties with host nations. These internationally educated students can also contribute to the home country's development upon their return by bringing back newly acquired skills and knowledge. In addition, India's large student population going abroad can encourage more inbound student mobility, promoting cultural exchange and international understanding (Fig-2). In conclusion, investing in knowledge diplomacy through a student-based approach could greatly help India leverage the educational prowess, innovation potential, and soft power of its students while contributing to global knowledge exchanges in the G20 setup.

Faculty Exchange-based

The teacher-based approach to knowledge diplomacy underlines the role of teachers, educators, and academic professionals in international educational exchanges and relations. The core of education diplomacy lies at the intersection of education, learning, and diplomacy, where education professionals engage in negotiation, facilitation, and mobilization of resources to ensure inclusive education opportunities.

Here are some ways how this approach can be manifested. Firstly, Teachers can participate in exchange programs where they teach in another country for a specified period. These experiences offer opportunities for cultural exchange, comparative insights into different pedagogical methods, and direct knowledge transfer between countries. Second, Teachers, particularly those involved in higher education, often collaborate with international peers on joint research projects. This fosters a sense of academic community beyond borders, facilitating the cross-pollination of ideas and innovative practices. Third, teachers can engage in capacity-building initiatives in developing countries, working with local educators to improve pedagogical practices, curriculum development, and overall educational quality.

Figure-2: Inbound Student Mobility Rates



However, despite the potential benefits, the teacher-based approach to knowledge diplomacy also faces challenges. The wealth and resource disparities between tertiary institutions in developed and developing countries can influence the opportunities available for teachers to engage in knowledge diplomacy. Teachers in well-resourced institutions are more likely to have opportunities for international collaboration and exchange. Further, differences in educational systems, pedagogical approaches, and cultural norms can be barriers to effective engagement in knowledge diplomacy. It takes time and careful negotiation to reconcile these differences for effective collaboration. In addition, though English is often used as the language of international academic exchange, a lack of proficiency in English or the host country's language can limit effective communication and engagement. Attuning to these challenges and creating constructive policies accordingly can maximize the effective contributions of teachers to knowledge diplomacy.

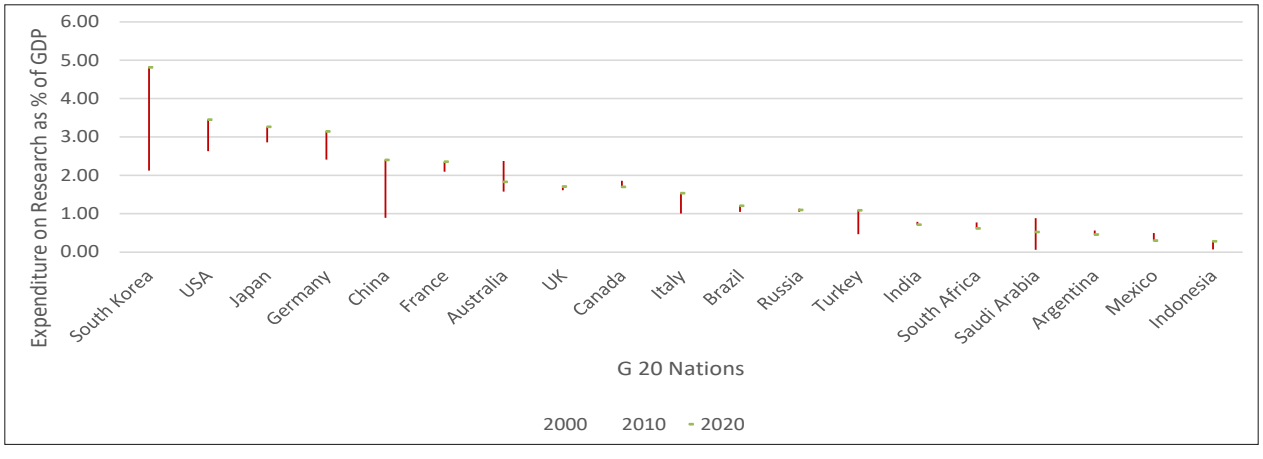
Research Collaboration-based

The significant impact of Research and Innovation on the economic development of a nation has been extensively discussed by renowned scholars such as Solow, Romer, and Barro. However, it is a matter of grave concern that India allocates only 0.71 percent of its GDP towards research endeavors (Graph-1). This figure pales in comparison to other G-20 countries like South Korea (4.81), the United States (3.45), China (2.40), and Australia (2.37) among others. Furthermore, India's performance in terms of international research collaborations ranks second to last among G-20 nations; with Saudi Arabia leading the list followed by France, Australia, UK and Canada in conducting collaborative research at an international level. Given these indicators, there exists ample opportunity for India to enhance its collaboration efforts with G-20 partners including Russia, USA, France, Saudi Arabia, Australia, and UK–all countries with long-standing diplomatic ties -thus fully capitalizing on their potential for research-based diplomacy.

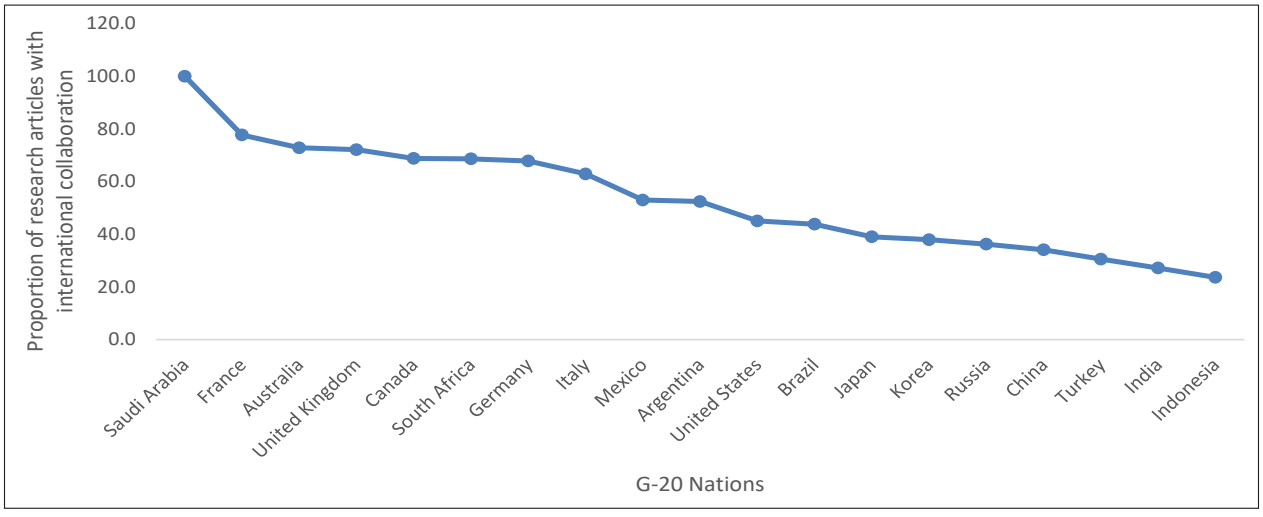
Vasudhaiva Kutumbakam: The India's Way

India faces numerous challenges in the internationalization of its higher education, research, and innovation. These obstacles hinder India's ability to engage in knowledge diplomacy independently. On a broader scale, the G20 is primarily focused on economic matters, making it difficult for India to effectively promote its knowledge potential within this framework. However, leveraging India's strong economic prospects, soft power status, and commitment to *Vasudhaiva Kutumbakam* (the concept of One Earth, One Family and One Future) could enhance the country's ability to showcase its knowledge assets within the G20 context. While India has demonstrated leadership in knowledge diplomacy within regional frameworks like SAARC and BIMSTEC in South Asia region; however, it does not hold a dominant position within the G20 as it does with SAARC or BRICS countries. Nonetheless, G-20 has acknowledged India as an important voice ever since joining this forum and hosting the presidency for the second time is a testament to that acknowledgment. Based on India's tradition and vision, a Framework of Knowledge Diplomacy in G-20 Set-Up containing suggestions for knowledge diplomacy has been created and presented in Table 3. Suggested.

Graph-1: Expenditure of Select Countries on Research



Graph 2: Proportion of Research Articles



Data Source: U 21 Statistics

India, with its philosophical notion of *Vasudhaiva Kutumbakam*, which translates into "the world is one family," brings a unique perspective to global diplomacy. This underlying principle as a theme of India's G-20 presents a lever for strengthening diplomatic relationships with G20 partners, especially friendly nations like France, Russia, USA, UK, Canada, etc., through the notion of knowledge diplomacy. By adopting a *Vasudhaiva Kutumbakam* approach, India accentuates its commitment to global cooperation and unity. This not only underlines its soft power status but also upholds the proposition that all the world's knowledge resources should be shared and leveraged for common prosperity. This philosophical lens can enhance the country's IHERI collaborations, fostering scientific and academic exchanges, joint research projects, student/scholar exchanges, and more. Countries like France, Russia, the USA, the UK, and Canada, which have notable ties with India,

Table 3: Suggested Framework of Knowledge Diplomacy in G-20 Set-Up

Rationale	Actors/ Partners	Values and Principles	Modes, Approaches	Activities, Instruments
To build/ strengthen relations between and among countries through international higher education, research and innovation (IHERI) To use IHERI to help address global challenges and promote peace and prosperity To strengthen IHERI through enhanced relations between and among countries	G 20 Countries, Education Ministers, Private Sector, NGOs, Scientists, and Academic Fraternity, Students, think tanks, centres of excellence	*Vasudhaiva Kutumbakam,* One Earth, One Family, One Future	Negotiation Communication Representation Conflict Resolution Compromise Collaboration Mediation Conciliation Building trust Dialogue	*Generic*: Networks Joint projects Conferences Summits Coalitions Track Two Agreements Working Groups Institution building *IHERI specific*: Intl joint universities Student/scholar exchanges Research networks Education/ Knowledge Hubs Scholarships ODA projects Twinning and Joint Degree Programs

could greatly benefit from strengthened knowledge-based alliances. The *Vasudhaiva Kutumbakam* philosophy fosters a spirit of openness and mutual reciprocity, beneficial in accelerating research collaborations, academic exchanges, and knowledge transfer, thereby collectively advancing toward shared global challenges.

Moreover, acknowledging the potential role of students as ambassadors of their home countries, future leaders, and facilitators of intercultural dialogue, can also strengthen knowledge diplomacy. Similarly, faculty exchanges underline the role of educators in international educational exchanges. Emphasizing the *Vasudhaiva Kutumbakam* perspective within such exchanges can amplify bilateral and multilateral educational collaborations, fostering a deeper understanding and inclusion of diverse knowledge systems. India's emphasis on the *Vasudhaiva Kutumbakam* philosophy could also encourage other G20 nations to foster a similar approach to global diplomacy, which could further contribute to a broader shift towards knowledge diplomacy, strengthening diplomatic alliances, and nurturing an environment of global cooperation and shared prosperity.

Concluding Remarks

In conclusion, the G20 forum presents a stellar opportunity for India to not only refine its position in knowledge diplomacy but also emerge as an influential player in shaping the dynamics of the evolving global order. It provides a platform to broaden the horizons of its diplomatic objectives - moving from a primarily economic focus to incorporating an intellectual and educational stance. The concept of *Vasudhaiva Kutumbakam*, India's unique philosophy of "the world is one family", could serve as a defining catalyst in this diplomatic transformation. India's embrace of knowledge diplomacy via the G20 indicates an appreciated shift from the traditional power paradigm towards a knowledge-centric approach to international relations. It signifies that power is no longer solely in the realm of economic or military might; it also resides in access to, control of, and collaboration in knowledge. India's dedication to the principles of *Vasudhaiva Kutumbakam*, in the context of knowledge diplomacy, has the potential to redefine the narrative of intellectual collaboration, consensus-building, and mutual prosperity. The role of knowledge diplomacy is rapidly gaining traction in international relations, notably with G20 countries gradually emphasising 'Knowledge Diplomacy' during their respective presidencies post-2018. This sets a persuasive precedent for India to follow suit and harness the untapped potential of its intellectual and educational assets. Such a shift would not only foster inclusive global cooperation but also significantly enhance India's international profile. In the light of an increasingly interconnected world, addressing global challenges necessitates global solutions. As the embodiment of the philosophical notion *Vasudhaiva Kutumbakam*, India stands poised to establish itself as a leader in fostering global unity and cooperation through knowledge diplomacy. Therefore, it is the call of the academic community worldwide to keep a keen eye on this evolving landscape of international diplomacy - with India at the crux of a potential seismic shift in global power dynamics.

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Paradigm Shift in Research Strategies toward Collaborations: From Unidisciplinary to Multidisciplinary, Interdisciplinary and Transdisciplinary Approaches

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The paradigm shift in research methods was brought out through the extensive application of Collaborative Research thereby affecting the balance of research in the higher education system, particularly in Science, Technology, Engineering, and Mathematics (STEM) Education. Demands for solving complex real-world problems gradually increased and have become a challenge for Higher Education Institutions (HEIs), Research Organizations, Policy Makers, and Politicians too. Scientists, Researchers, Policymakers, and even Politicians started understanding the importance of collaborative strategies in teaching-learning and research which can accelerate both the quantity and quality of education as well as the Research outputs.

The trend of shifting towards collaborative strategies from *'One-Paper–One-Author'* to *'One-Paper – Multiple-Authors'* has been initiated in the 1920s, gained momentum in the 1950s, and acquired prominence by the 1980s (Greene, M. (2007)[1]. The study conducted by He, Z.-L., Geng, X.-S., & Campbell- Hunt, C. (2009)[2] revealed that- *"...* Collaborative research has been increasingly celebrated by the science community, but the hypothesized positive relationship between research collaboration and research output is more assumed than rigorously tested." Adams, J. (2012)[3] commented, "Collaboration is normally a good thing from a wider public perspective. Knowledge is better transferred and combined by collaboration, and co-authored papers tend to be cited more frequently. But could increased global collaboration mean a blending of objectives that risks leaving bland priorities?"

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It is revealed from the Web of Science Data, that currently, the US has collaborated in about 3–4% of its papers with each of the UK (with 19,090 papers in 2011), China (with 19,141), and Germany (16,753). US collaboration with Asia is rising steeply, as is collaboration between countries in Western Europe. Rapid growth in China, since 2000 is leading to closer research collaboration with Japan (increase 4 times since 1999), Taiwan (up 8 times), South Korea (up 10 times), Australia (more than 10 times), and every other research-active country in the Asia- Pacific region (Adams, J. 2012)[4].

India has a growing research network with several countries throughout the globe. India has notified and implemented the "National Education Policy 2020"[5], which emphasizes Collaboration Strategies, particularly on Multidisciplinary Approach in Education System. The UGC[6] has published 'Guidelines for Transforming HEIs into Multidisciplinary Institutions'(MDIs)[7].

Literature Reviews

Shifts towards collaborative research and co-authorship are gradually increasing, which are mainly Multidisciplinary, Interdisciplinary, and Transdisciplinary in nature. These are the most predominated research approaches; however, there are similarities and dissimilarities too (NS State University-2020)[8]. It is mentioned in the Report of the "International Partnerships of Research Excellence UK– USA Academic Collaboration (ed. Robert, G. 2006)[9] that – UK Government had published a ten-year strategy for science and innovation in July 2004, and had emphasized a commendable strategy of outward-looking towards global partnerships, highlighted the importance of building research links with the rest of European Union and improving networks in China, India, and other countries.

Greene, M. (2007)[10] stressed two qualities of Scientific Research – 'Increment of Scientific Ideas' and 'Credit for Discovery'; and commented that *"Collaboration in multidisciplinary research is now universal as well as essential, and we determine from*

the list of authors who shares in the credit. Curiously, however, in most journals, we are not told which of these did what part of the work, nor may we be certain (have we ceased to care?) who drafted the paper."

'Co-authorship' is a vital indicator of collaboration, which is a more symmetrical approach in comparing the costs of collaboration with the undoubted benefits when considering formulating strategies and policies toward research collaboration [Katz, J., & Martin, B. R. (1997)][11].

John Whitfield (2001)[12] said regarding issues of *Nature*[13] in 2001, there were only six single-author papers out of a total of 700 reports, and the proportions would be similar in other leading Research Journals too. Adams, J. (2012)[14] made similar comments; he found that the first paper with 1,000 authors was published in Nature in 2004; a paper with 3,000 authors came in 2008. By 2015, there were 120 physics papers had more than 1,000 authors and 44 had more than 3,000 authors (King, C. 2012)[15]; many of which were from collaborations at the Large Hadron Collider at CERN[16], Europe's particle-physics lab near Geneva, Switzerland.

Bu, Y., Ding, Y., Liang, X., & Murray, D. S. (2017)[17] indicated that Scientific collaboration is inevitable in many research fields. They had given importance to exploring the diversity of research collaborations. Bordons, M., Zulueta, M. A., Romero, F., & Barrigón,S.(1999)[18] commented that Publications of MRP groups showed a higher interdisciplinary collaboration rate than the rest of the UCM (17% vs. 9%)"; which had revealed from a study conducted in '*Universidad Complutense de Madrid'* (UCM)[19], Spain, to support cross-disciplinary research projects; which was being developed as a Multidisciplinary Research Programme (MRP) since 1989.

Cummings, J. N., & Kiesler, S. (2005)[20] had conducted a study to investigate scientific collaboration across disciplinary and university boundaries to understand the need for coordination, funded by US National Science Foundation (NSF)[21] in 1998 and 1999; positive outcomes had revealed. Disis, M. L., & Slattery, J. T. (2010)[22] recommended on the basis of a study on Health Care that- Several academic institutions had invested in conducting many educational programmes, facilities, and enhanced resources to encourage translational research; which are critically needed giving emphasis on creating and sustaining multidisciplinary research teams.

Jones, B. F., Wuchty, S., & Uzzi, B. (2008)[23] had examining 4.2 million papers published over three decades and found that there were multi-university collaborations. They commented that- collaborative teamwork has made a dramatic shift in knowledge production that generalizes across virtually all fields of science, engineering, and even in social science arenas.

National Science Foundation (NSF)[24] developed a topic map of all of their awards issued between 2000 and 2011, which provides a novel means for measuring interdisciplinarity by assessing the language or content of award proposals [Nichols, L. G. (2014)][25]

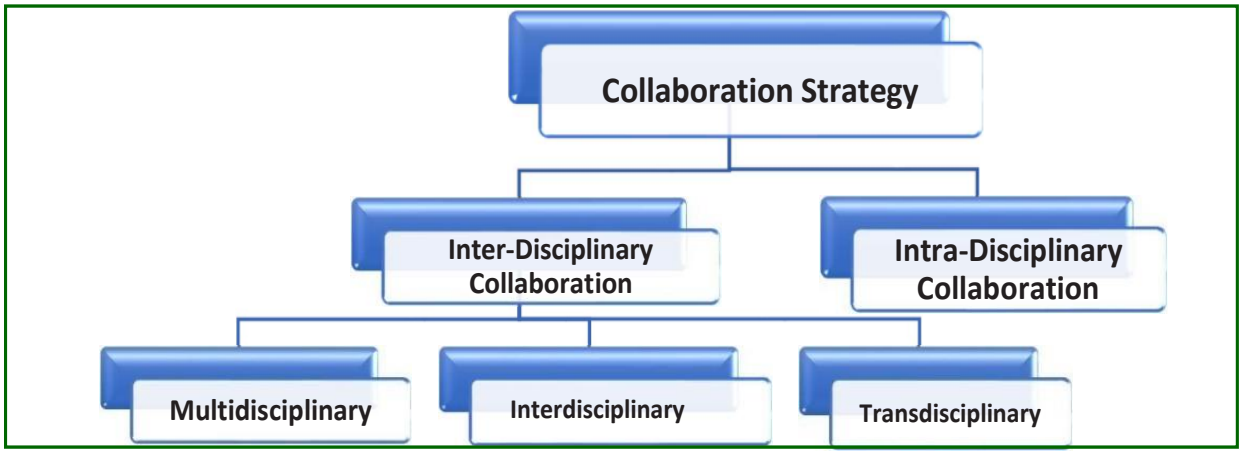
Porac, J. F. et.al. (2004)[26] and his co-researchers compared the publication outcomes of two teams within a multi-university scientific alliance, which revealed that when the alliance had been made between two teams, it increased the productivity of both teams at the highest level for the more heterogeneous team. In the heterogenous team, a variety of knowledge and concepts were employed in their research which yield initially higher outputs.

From the above-noted Literature Review, it has been revealed that education and research approaches are rapidly shifting their strategies towards collaborations during the past several decades, which leads towards policy and organizational reforms and collaboration among different disciplines, researchers, scientists, HEIs, Industries, and Government Organizations too.

Emergence of Collaborative Strategies in Academia: Disciplinary, Multidisciplinary, Inter-disciplinary and Transdisciplinary

Collaboration in teaching-learning and research strategies may be of two types- 'Intra- Disciplinary' and 'Inter-Disciplinary'. The 'Intra-Disciplinary Collaborations' may be within the same Discipline of different Institutions of the same country and different countries. But on the other hand, 'Inter-Disciplinary Collaborations' are made within different Disciplines; which may be of the same Institution or different Institutions within the same country, or globally; and may be between HEIs and Industries/ Societal Organizations. 'Interdisciplinary Collaborations' are mainly of three types- (1) Multidisciplinary, (2) Interdisciplinary, and (3) Transdisciplinary.

Figure-1: Types of Collaboration Strategy



Different Types of Approaches

Several Educationists and Academic Organizations have defined the terminologies. However, definitions made by the International Bureau of Education, a unit of UNESCO are widely accepted.

Uni-disciplinary Approach

Concentrating the research or teaching in one single discipline is called Uni-disciplinary. The salient feature of the Uni-disciplinary approach are:

- Advancement of Frontiers of Knowledge of Specific Discipline.
- From the point of view of a single discipline boundary exists
- Problem-solving within its periphery; no cooperation with any other Discipline.
- Specific Disciplinary Research Outputs are revealed.

Multidisciplinary Approach

Multidisciplinary Approach as defined by IBE, UNESCO is, "An approach to curriculum integration which focuses primarily on the different disciplines and the diverse perspectives they bring to illustrate a topic, theme, or issue. A multidisciplinary curriculum is one in which the same topic is studied from the viewpoint of more than one discipline. Frequently multidisciplinary and cross-disciplinary are used as synonyms describing the aim to cross boundaries between disciplines,"(IBE, UNESCO)[27]. The Emergence of Multidisciplinary Subjects is depicted in Figures 2 and 3.

Salient Features of Multidisciplinary-Approaches are:

Research-Approaches: Enhancement of understanding of observed phenomena from several Disciplinary Perspectives.

Strategy: All Disciplines stay separately, but contribute inputs for solving common real-world problem(s).

(i) Perspectives: Researchers from different disciplines work together.

(ii) Problem-solving: Need Discipline Expert's Opinion towards solving the problem.

(iii) Integration: No Integration of Disciplines, but Integration of Curriculum is needed where Cooperation & Contribution of Disciplines are involved.

(iv) Disciplinary-Boundary: Disciplinary boundaries exist; never cross the border.

(v) Theory: Need development of Disciplinary Theories.

Research-Outputs: Separate Disciplinary Output on the Specific Problem.

Interdisciplinary-Approaches

Definition of Interdisciplinary Approach as defined by IBE, UNESCO is, *"An approach to curriculum integration that generates an understanding of themes and ideas that cut across disciplines and of the connections between different disciplines and their relationship to the real world. It normally emphasizes*

Figure-2: Multidisciplinary Project on ' Awareness of Water

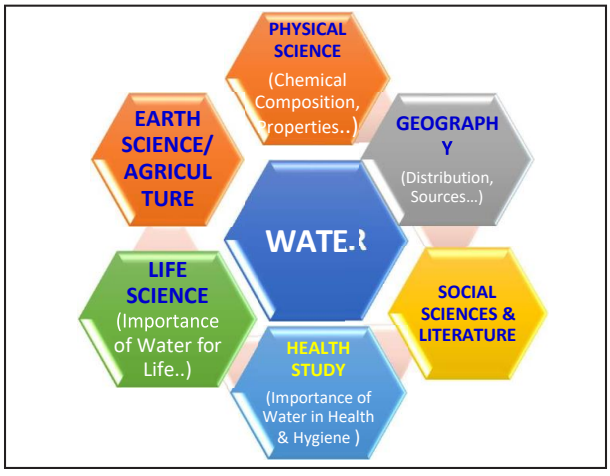
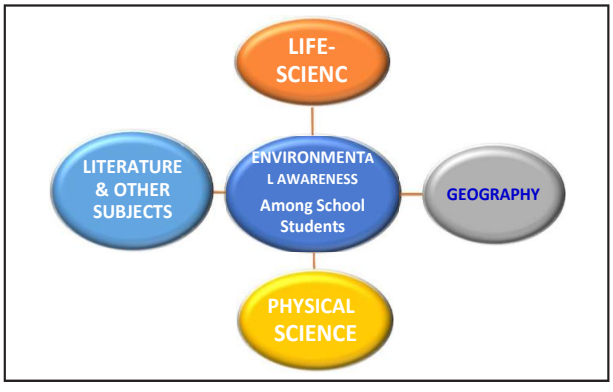


Figure-3: Multidisciplinary Project on 'Environmental Awareness



process and meaning rather than product and content by combining contents, theories, methodologies, and perspectives from two or more disciplines, (IBE, UNESCO).[28]

"Facilitating Interdisciplinary Research examines current interdisciplinary research efforts and recommends ways to stimulate and support such research," (National-Science-Academy-Report-2005)[29]. The Emergence of Interdisciplinary Subjects is depicted in Figure-4. Salient Features of Interdisciplinary Approaches are:

***Research-Approaches*:** Integration of Disciplinary knowledge for understanding holistically the phenomenon.

***Strategy*:** Multiple Disciplines collaboratively integrated and blended.

(i) Perspectives: Integration of Knowledge and Methodology from Participating Disciplines.

(ii) Problem-solving: Focused on problem framing & solving from cross-Disciplinary perspectives

(iii) Integration: Stronger Integration of Curriculum from Disciplinary Perspectives and Cooperation.

(iv) Disciplinary-Boundary: Disciplinary Boundaries are overlapping.

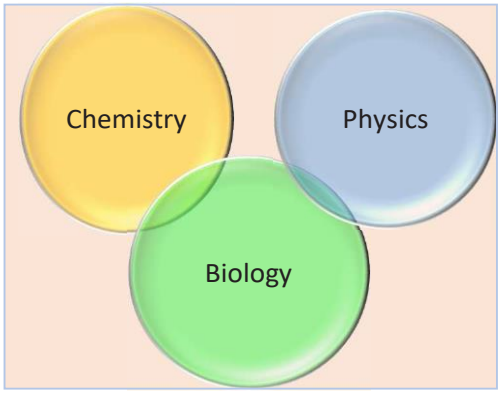
(v) Theory: Need Integration in understanding formulating proper methodology, and epistemological and ontological Perspectives

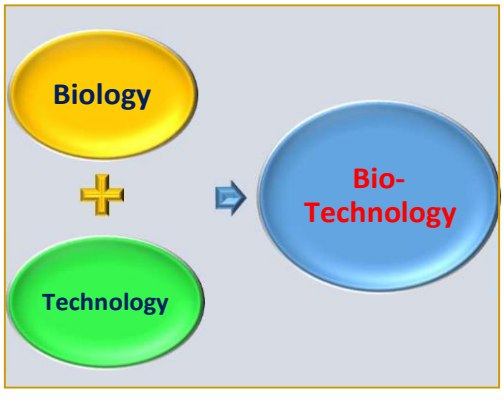
***Research-Outputs*:** Integrated Research Outputs.

Transdisciplinary Approach

Definition Transdisciplinary Approach as defined by IBE, UNESCO is, ***"An approach to curriculum integration which dissolves the boundaries between the conventional disciplines and organizes teaching and learning around the construction of meaning in the context of real-world problems or themes."*** – (IBE, UNESCO)[30]. The emergence of Transdisciplinary Subjects is mentioned in Figure -5. Salient Features of the Transdisciplinary Approach are:

Figure-4: Sharing of Disciplinary Boundaries for Developing the Interdisciplinary Subjects





***Research Approaches*:** Integration and cross-fertilization of Disciplinary knowledge, and expertise for developing new methodology, tools, and techniques.

***Strategy*:** Develop Cross-fertilized common strategy jointly by experts of different Disciplines, Policy-Planners, Investors, and other stakeholders.

(i) *Perspectives*: Creating a cross-fertilized perspective of Intellectual frameworks beyond the Disciplinary perspectives

(ii) Problem-solving: Solving problems by going beyond Disciplinary perspectives through involving Researchers, Practitioners, Policy-makers Beneficiaries and other stakeholders, and Industry concerns.

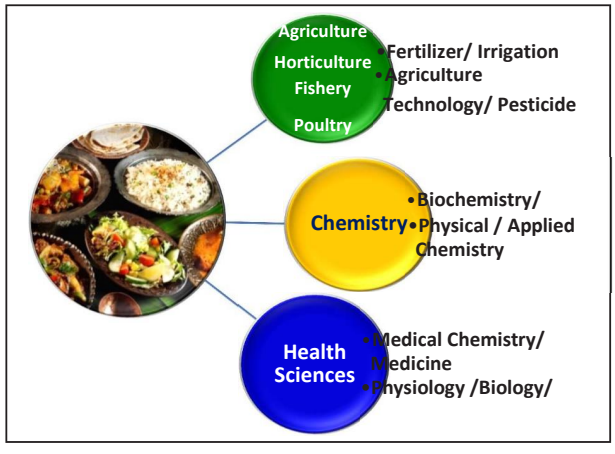
(iii) *Integration*: Stronger Integration of Curriculum & Perspectives and Cross-Fertilization of Expertise from several Disciplines.

(iv) Disciplinary-Boundary: All Disciplinary boundaries would be dissolved; creates a new boundary depending on the need for solving the problem(s).

(v) Theory: High level of integration of all Disciplines needed to Cross-Fertilize new methodology, tools, and techniques.

***Research-Outputs*:** Integrated and Cross-Fertilized Strong Research Output.

Figure- 5: Food: Transdisciplinary Research



Some Guiding Principles for Successful Implementation of Collaborative Research Strategies

For effective implementation of Collaborative Research Strategies, it is very important to identify very scientific real-world problems and engineering ground breaking technologies, which requires good teams of researchers from different disciplinary backgrounds to work together and positive attitudes towards collaborative work.

Collaborative Research Strategy, whether it is Multidisciplinary or Interdisciplinary Transdisciplinary, would be determined depending on the characteristics and complexity of the real-world problem(s). There are specific guiding principles for each category of the research collaborative strategies; however, the following are some of the common guiding principles which may be applicable to collaborative approaches; some modifications/ moderations may be needed.

Learn the Language

Each discipline and laboratory has its own unique 'language', and common Terminologies; those should be clearly defined depending on the collaborative common strategy.

Make an Operational Plan

An operation plan shall be framed at the beginning of the Project, including the role and objectives of each Discipline, cross-fertilized ideas, new Strategies, job-distribution-schedule, and training to co-researchers for maintaining discipline.

Address Differences in Operation

Formulation of common Communication Strategy and useful Reporting Tools, preparing Reports of each Disciplinary group and circulating among all before monthly meetings.

Share of Credits

A comprehensive guideline shall be developed regarding 'Authorship', 'Manuscript Writing', 'Credit allocation and Transfer', and 'Patent Rights' of the co-researchers and the Principal Investigators (PIs).

Share the Funds

Well-defined 'Financial Planning and Budget' shall be formulated. Lead PI should not control the Fund alone; all PIs shall agree to share the financial resources.

Discuss Project Plans & Time Management

Working Project Plan, Objectives and Long-Term & Short-Term Goals, Allotment of Activities, and Planning of Time Management shall also be pre-defined.

Hold Frequent Meetings

Planning and Routine for monthly and quarterly/ annual meetings, submission of Progress Report by each Discipline, and provisions for re-grouping and reallocation of team members on a regular basis may be made.

Encourage Open Communication: Be Fair & Respectful

Transparency, equality, and freedom of expression of views of all co-researchers shall be maintained.

SWOT Analysis is essential before starting any Collaborative Research Project

The analysis is badly needed before taking any strategic planning/ project. The analysis is called situational assessment or situational analysis. SWOT Analysis is a popular technique, which is designed mainly for use in the initial stages of decision-making processes of any project and can be used as a vital tool to evaluate the strategic position of the organization(s) of many kinds (for-profit enterprises, local and national governments, NGOs, etc. (Wikipedia)[31]. Additional acronyms using the same components include TOWS and WOTS-UP.

"SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is a framework used to evaluate a company's competitive position and to develop strategic planning. SWOT analysis assesses internal and external factors, as well as current and future potential." (Kenton, W.- 2022)[32]

Strengths and Weaknesses

Following internal factors within collaborating organizations may be the Strengths or Weaknesses, which must take into consideration.

(i) Human Resources-PIs, Researchers, staff, volunteers, board members, target population

(ii) Physical Resources– Infrastructure of collaborating Institutions/Organizations, their Laboratories / Workshops, Equipment, Locational advantages/ disadvantages;

(iii) Financial- Grants from Funding Agencies, Resource sharing, and other sources of income;

(iv) Integration of cross-fertilized Ideas- Innovative Ideas of PIs and Researchers of collaborating Organizations would increase the strength of Research-output; on the contrary, the possibility of arising conflicts would be a great weakness.

(v) Past Experiences & Reputation- of the collaborating Organization yield fruitful Research-output; or *vice-versa*;

(vi) Activities and Processes- Joint effort in programme execution; upgradation of systems.

Opportunities and Threats (Risks)

Following external factors arising from Governmental organizations and society may create opportunities, on the contrary, they may create problems/threats.

(vii) Legislations/Policies- New national/international Policies, Future trends in societal demands, Strategies of collaborating organizations;

(viii)Economy- Institutional, national, or international economic strategies;

(ix) Funding-Sources- Institutional and new strategies of Fudging Agencies, donors, legislatures;

(x) Demographics- Demographic positions of collaborating Institutions and the study area;

(xi) Physical-Environment- Is the building in a growing part of town? Is the bus company cutting routes?

(xii) Local, National, International Demands- Research outputs depend on the urgency and complexity of the Real-World Problem(s) for which a collaborative Research Strategy has been adopted.

Conclusion

Though the shift of research from Uni-disciplinary to Collaborative, i.e., Multidisciplinary, Interdisciplinary or Transdisciplinary is considered a time-taking and complex system these have a significant effect on research outputs towards solving complex real-world problems. Collaborative strategies enhance and accelerate collaborations between several researchers of different Disciplines, HEIs, Industries, policymakers and Societal Organizations and induce crossbreeding of new innovative ideas, resource-sharing, effective use of funds, bondage between co-researchers, institutions, increase global friendship which yields stronger research-outputs towards solving the complex real-world critical problems; ultimately used for societal benefits.

From the above study, it has been revealed that STEM Education has already been rapidly shifting its strategies towards collaborations during the past several decades, and it is a continuing process. Several approaches and organizational reforms have evolved

for administrating collaboration among different disciplines, researchers, scientists, HEIs, Industries, Government Organizations and societal bodies throughout the globe towards productive outputs for solving the ever-emerging complex real-world problems for the cause of societal benefits.

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Flipped Learning an Innovation in Pedagogy of Modern-day Classrooms

Aerum Khan*

The vision of Education drawn from National Education Policy—2020 (NEP 2020) is developing an equitable and vibrant knowledge society. The NEP 2020 document reads: "The purpose of the education system is to develop good human beings capable of rational thought and action, possessing compassion and empathy, courage and resilience, scientific temper, and creative imagination, with sound ethical moorings and values. It aims at producing engaged, productive, and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our Constitution." (NEP 2020).

The NEP–2020 further elaborates on the aim of education "The aim of education will not only be cognitive development, but also building character and creating holistic and well-rounded individuals equipped with the key 21st century skills. Ultimately, knowledge is a deep-seated treasure and education helps in its manifestation as the perfection which is already within an individual. All aspects of curriculum and pedagogy will be reoriented and revamped to attain these critical goals."

Keeping the above goals in mind, it becomes mandatory to rationalize and modernize ways of teaching and updating pedagogies in consonance with 21st-century needs. The educational practices and strategies should cater to enhancing the knowledge of students, building their capacities, and inculcating values and dispositions that are necessary for the holistic development of an individual.

As NEP 2020 recommends, "Education thus, must move towards less content, and more towards learning about how to think critically and solve problems, how to be creative and multidisciplinary, and how to innovate, adapt, and absorb new material in novel and changing fields. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centered, discussion-based, flexible, and, of course, enjoyable." To achieve these goals, our country must develop an education system based on equity and gender parity that focuses on the holistic development of its future citizens.

Teaching Methods

Education is a great leveler and is an important medium for achieving economic and social mobility, inclusion, and equality. The government must ensure timely interventions to create opportunities for all to enter and excel in the educational system irrespective of caste, creed, sex, gender, etc. Keeping this view in mind, the teaching-learning techniques must be designed in such a way that equips the learners with 21st-century skills of critical exploration, collaboration, divergent thinking, decision-making, etc. But the traditional teaching methods fail to meet such requirements and they prepare students to pass in exam through rote learning only. It seems there is a lack of alignment between objectives, activities, and assessments in traditional teaching. Teaching learning methods can be broadly classified as Traditional and Modern methods based on processes and methods employed in teaching.

Traditional Teaching Methods

Traditional teaching methods which are also known as conventional teaching methods are still used in schools on a wider scale. In the traditional teaching methods, the classes are teacher-centered and portray the teacher as a sage on stage whose work is to preach and profess. The environment of the traditional class makes students passive listeners rather than allowing them to be active participants.

Traditional teaching methods encourage compliance, and conformity and discourage innovative thoughts and divergent thinking among the students. Rules and regulations are exercised in the classroom in such a way that it keeps students' behaviour in check. Teachers are responsible for imparting knowledge and maintaining the standards of behaviour in the school. Traditional teaching methods emphasized hand-holding, dictating, constant guiding and even rebuking on mistakes

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at times. Such guided instructions make students dependent on teachers completely and are a great hindrance to the development of decision-making in students. Student psychology becomes overly dependent on instructions and often leads to underdeveloped thinking processes.

The Education system has been evolving with time. With the advent of science and technology, methods of teaching-learning have gone digital and become more child-focused. In modern teaching methods, teachers teach every student on a different level and adjust their teaching styles to the academic needs of the students. They assume all students are different and apply different educational practices to them individually. The adjustment of teaching methods according to the academic and learning needs of students leads to Differential learning. Unlike old education, progressive teaching methods are based on activity, questioning, explaining, demonstrating, and using collaboration techniques.

Modern Teaching Methods

The modern teaching method is more activity-based and child-focused. In the modern teaching method, curriculum teaching and planning are done keeping the learner as the primary target. In recent years, the scope of knowledge in the field of science and technology has dramatically increased and humans have adapted their lifestyles accordingly. As human minds have an innate curiosity to know and explore areas of different fields, they strive to adopt modern ways in this knowledge-driven era of technology. The characteristics of modern teaching methods include learner-centered, Task-based, Activity-based, Collaborative, Integrative in nature, Interdisciplinary, and Blended which employ both online and offline modes.

One of the very effective teaching-learning methods is Flipped teaching which is also known as Inverted learning. It hinges on the idea that students learn more effectively by using class time for small group activities and individual attention. Teachers then assign students lecture materials and presentations to be viewed at home or outside of the classroom day, prioritizing active learning.

According to Kari M Arfstrom, cofounder of the Flipped Learning Network, flipped learning is all about creating opportunities for active engagement. It's "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter."

The flipped learning approach is gaining value every year. According to a 2014 survey from the Flipped Learning Network, 78 percent of teachers said they had flipped a lesson, and 96 percent of those who tried it said they would recommend it to other educators. This indicates that flipped learning inspires teachers to update traditional methods and bring new technology into their classrooms using video, screencasts, and more.

Bergmann and Sams (2012) have described the Flipped Classroom approach in a wider view. According to them, the Flipped Classroom approach is a setting where students take charge of their learning. This increases communication and contact time between students and teachers. The Flipped Classroom approach then gives priority to students where all students are engaged in their learning and the teacher becomes the 'guide on the side' and not the 'sage on the stage' as described by Baker (2000).

This implies that Flipped classroom makes the class more democratic where students are free to explore various resources for the topic and study them at their own pace and convenience. Moreover, the flipped classroom is more activity-based and interactive where students learn collaboration and coordination by themselves. A flipped classroom does not restrict itself to sharing online videos, pictures, lectures, or tutorials rather teacher is also involved in activities both before and after the class. The introduction of the content beforehand with the help of a small lecture or by playing quizzes and games ensures equal participation of teachers and students.

The in-class time in a flipped classroom is usually noisy and disorganized as compared to traditional classes. In the Flipped Learning model, there is a switch from a teacher-centered classroom to a student-centered approach where class time is determined for exploring the content of the topic to a greater extent and creating a richer learning environment.

Essential Components of Flipped Classroom

Moreover, lessons should include four major components to be entitled as the Flipped Classroom (Flipped Learning Network [FLN], 2014). First, educators should restructure the learning environment and time in a flexible way, considering individual and group expectations and needs. Second, instructors need to teach the contents in detail, adopting a learner-centered approach and providing rich learning opportunities and activities reflecting a particular learning culture for specific groups of students. Third, educators should regularly keep track of the difficulty level of the contents and the notes taken by the students as well as their progress, and they also apply active learning strategies that will maximize the conceptual understanding of the students. Finally, the instructor should be a professional educator who continuously monitors students in their learning processes, immediately provides feedback, and assesses students' outputs.

Flipped teaching is a specific variety of blended instruction in which traditionally in-class activities (especially lectures) are done as homework, while traditional homework activities (like working through practice exercises) are done in class.

Review of Related Literature

Bergmann and Sams (2012) have described the Flipped Classroom approach in a wider view. According to them, the Flipped Classroom approach is a setting where students take charge of their learning. This increases communication and contact time between students and teachers. The Flipped Classroom approach then gives priority to students where all students are engaged in their learning and the teacher becomes the "guide on the side" and not the "sage on the stage" as described by Baker (2000).

The flipped teaching method has been used throughout history, although no specific name was given to it. Professors assigned readings, especially in the literature-based courses, as homework and discussed the topic during class. The homework assigned to students by teachers, to be completed at home was a nascent kind of Flipped teaching method which existed earlier also. In the late 1990s, several educators were independently attempting to find student-centered active learning teaching methods. Dr. Erik Mazur, known for peer instruction, is one of the earliest educators to have adapted flipped teaching. Lage et al. identified a gap between the various learning styles of students, such as group work, project-based learning, experiential learning, and the traditional lecture method that the educators used. However, there were limitations in incorporating alternate instructional approaches to meet the different learning styles among students while balancing the course content because it required increased class time to meet all the learning preferences of students Dr. J. W. Baker designed a teaching approach assigning lecture content as homework and class time to master the information. Advances in educational technology that were taking place at the time, such as access to multimedia and the ease of multimedia development by the faculty, allowed the birth of a new teaching method. Lage et al. and Baker coined the term "Inverted Classroom," and Baker called it "Classroom Flip." In this newly found teaching method, lectures were shifted from the classroom, and, during the in-class session, the students applied their knowledge in activities to strengthen their understanding of the topics.

In the mid-2000s, Jonathan Bergmann and Aaron Sams recorded their chemistry lectures, uploaded them to YouTube, and required their students to watch the videos before class to reach and develop concepts further for their students. By doing so, students were better prepared and had interactions that led to greater discussions. The overall classroom experience improved for both students and instructors. Another teacher Salman Khan taught math remotely to his young family members by uploading YouTube videos. These videos were reaching tens of thousands of students per month. The popularity of his teaching strategy led to the origin of Khan Academy, a non-profit organization that provides free lessons to all students. Although resources are freely available through Khan Academy and similar platforms, students typically lean toward instructor-generated resources that appear to enhance their learning.

Flipped Teaching Design

The Academy of Active Learning Arts and Sciences is a non-profit organization dedicated to establishing the Global Standards framework for Flipped Learning. These standards were built on widely acknowledged norms and best practices

worldwide. Based on these principles, the flipped teaching design consists of two major components: pre-class and in-class activities. Students are introduced to the content individually in the pre-class coursework. The application of knowledge, where students learn, practice, and master the material, occurs during the in-class sessions. Students become responsible for their learning, and it also allows opportunities to learn from peers.

The flipped classroom model is based on the idea that traditional teaching is inverted in the sense that what is normally done in class is flipped or switched with that which is normally done by the students out of class. Thus, instead of students listening to a lecture in class and then going home to work on a set of assigned problems, they read course literature assimilate lecture material through video at home, and engage in teacher-guided problem-solving, analysis, and discussions in class. Proponents of flipped classroom list numerous advantages of inverting teaching and learning in higher education according to the flipped classroom model: it allows students to learn at their own pace, it encourages students to actively engage with lecture material, it frees up actual class time for more effective, creative and active learning activities, teachers receive expanded opportunities to interact with and to assess students' learning, and students take control and responsibility for their learning (Gilboy, Heinerichs, & Pazzaglia, 2015; Betihavas, et. al., 2015).

McLaughlin et al. (2013) and McLaughlin et al. (2014) analysis of pharmacy students' experiences of flipped classroom courses revealed that students prefer learning content before class and using class time for applied learning and that students who learned through a flipped classroom approach considered themselves more engaged than students attending traditional courses. Similar findings were obtained by Davies, Dean, and Ball (2013) who compared three different instructional strategies in an information systems spreadsheet course, and showed that students attending the flipped classroom course also were more satisfied with the learning environment compared to the other treatment groups. Several studies report that students enjoy being able to learn at their own pace and that they prefer flipped classrooms over traditional approaches (Butt, 2014; Davies et al., 2013). The design principles for the flipped classroom recommended by Kim, Kim, Khera & Getman (2014) are as follows:

- Providing an opportunity for students to gain preliminary information before the class activity,
- Encouraging students to watch online lectures and be prepared before the class activity,
- Organizing methods of assessment,
- Linking in-class activities with out-of-class activities,
- Supplying clearly stated and well-organized guidance,
- Providing sufficient time for the completion of assignments,
- Promoting students to build a learning community,
- Providing immediate feedback on individual or group works,
- Providing the use of familiar technologies which can be accessed easily by students.

Enfield (2013) explained that students are encouraged to move out of the classroom to learn anytime and anywhere by flipped classroom approach. The most useful study strategy can be chosen and used by students while moving at their own pace through the instruction. Hung (2015) demonstrated that students' participation, satisfaction and performance showed a positive change after taking part in this pedagogical approach.

McLaughlin and Rhoney (2015) expressed that the awareness of instructors who used the flipped classroom approach has increased concerning teaching strategies. In addition, Kong (2014) stated that teachers improve the sort of resources they have, experience reflective discussions and share their instructional practices by using the flipped classroom model.

Reasons for Opting the Flipped Classroom

- Flipping helps busy and struggling students it helps students of all abilities to excel.
- Flipping allows students to pause and rewind their topic.
- Flipping increases student-teacher interaction and student-student interaction.
- Flipping changes classroom management.

- Flipping educates parents and is a great technique to deal with teacher absenteeism.

Conclusion

The use of Flipped teaching helps teachers to deal effectively with many students at a time. It enables the teachers to articulately design their lesson plans and deliver them in the most effective way. If done properly, it ensures maximum participation of the entire class through group activities, leaving no one behind. Even the weak students are motivated to learn through various collaborative activities like team presentations, quizzes, discussions etc. Moreover, the use of technology in the classrooms in the form of personalized videos, lessons, lectures, online study material enables students to prepare the content beforehand at their own pace and comfort.

Since the students from Government schools are mostly from poor social economic background and many are First generation learners, hence the responsibilities of teachers increase many folds. They must work on foundational skills of students as well as support them to pursue Higher education too. Hence, use of innovative teaching learning strategies become imminent which works on developing cognitive, motor and affective abilities of students. One such method of learning is Flipped teaching which equip students with 21st century skills like critical thinking, problem solving, effective communication, critical thinking, etc.

Weblinks

https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

https://youtu.be/ZaWFpzZ1obI?list=PLJoALJA_KMOB5wMKSFaXj4IcDMUDDjwiy

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Innovative Problem Solving at the Heart of Artificial Intelligence

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Artificial Intelligence (AI) has been defined and understood in different ways over the years as technology progresses. Some understood it as making a machine behave or do things intelligently, as if done by humans (McCarthy, Minsky, Rochester, & Shannon, 1955; Minsky, 1968; Patra, n.d.). While for some, they are just machines that do things for humans effectively, thus making their lives easier and more convenient (Tai, 2020). Kaplan and Haenlein (2018) defined it as "a system's ability to interpret external data correctly, to learn from such data, and to use those learnings".

There is a shift in the digital world from 'Internet of People' to 'Internet of Things'. International Business Machines (IBM) corporation refers to the Internet of Things (IoT) as a network of physical devices, vehicles, appliances, and other physical objects that are embedded with sensors, software, and network connectivity that allows them to collect and share data. The new media is often referred to as "Disruptive New Media" enabled through a network of interconnected devices. The space created by the functioning of interconnected devices, the so-called "cyberspace" is impacting our lives daily. The digital transformation that is taking place due to emerging technologies, including robotics, the IoT, and artificial intelligence, is known as the Fourth Industrial Revolution - and COVID-19 has accelerated the use of these technologies (Marchant, 2021).

According to the UNESCO World Commission on the Ethics of Scientific Knowledge and Technology (2019), machines based on AI "are capable of imitating or even exceeding human cognitive capacities, including sensing, language interaction, reasoning and analysis, problem-solving, and even creativity." This corroborates with what is classified as 'Strong AI', which, if achieved, will be able to outperform humans at cognitive tasks and have the cognitive capacities of humans. They will be able to think like humans. Although, the idea of such AI has been argued against, the well-known ones being the Chinese Room Argument by John Searle (1980) that challenges the classic Turing Test (1950) and Incompleteness Theorem by Kurt Godel (1930) as mentioned in 'Philosophy of AI', 2021.

The 'Weak AI' also known as Artificial Narrow Intelligence (ANI) is generally used for specific purposes, and functions in a specific or narrow sense. Examples may be facial recognition, voice recognition, self-driving cars, chess-playing machines or software, AI-based devices with sensors, smart gadgets, and many applications for day-to-day usage such as obstacle sensors, and temperature sensors. Some advanced examples include multiple AI adaptive and customized characteristic simulations of virtual learning environments, administration, assessment, robotics of teaching, collaborative, personalized, flexible, and AI-facilitated experiential learning platforms, etc. Despite being inferior to 'Strong AI', it has come a long way, considering that not even 30 years ago, the world chess champion, Gary Kasparov was defeated by the Deep Blue program, which was such an important milestone (Buchanan, 2005). Now with significant progress, we move past programming systems with rules to arrive at our desired solution and move on to enabling machines to produce their own rules by learning from past data and identifying common patterns, hence essentially learning by itself.

Most highly advanced countries are patronizing AI such as Ireland, Malta, Finland, and other European nations, the US leading all spots worldwide and Asian countries such as China, Singapore, and South Korea have been able to provide complete digitization of public services (Harford, 2021; Ortiz, 2023). On a similar line Govt. of India also adopted a national policy through NITI Aayog, 2022. The government listed out key areas such as medicine, finance, manufacturing, and education to be taken up for AI interventions. In medicine, the prime focus will be on predicting and preventing (diagnostic and prognostic AI interventions) and on that basis, the analysis of the clinical history of patients is to be prioritized. Some advancements are deep neural medicinal technology emphasizing deep learning and automated detection of diseases such as COVID-19, based on big data technologies. The manufacturing sector is a promising sector in India that can promote local production. It is estimated that 20% of jobs in

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the UK are directly driven by AI. The policy promises around 133 million jobs in the national manufacturing scheme. In the finance sector, AI is booming in the form of fuzzy logic and neural network technologies. AI is used in chat automation, fraud detection, virtual assistance, banking services, and Universal Payment Interface (UPI) such as Fintech. Finally, in the field of education, AI has a lot of prospects in India in the time to come. Some important examples from abroad are the IBM Supercomputer in the USA answering complex questions and applications used at Deakin University, Australia. Applications of AI such as virtual learning environments, administration, assessment, robotics of teaching, and collaborative, personalized, flexible, and experiential learning platforms are all facilitated through AI.

A recent statement by Lance Eliot is a satire on one extreme possibility of Artificial Intelligence (AI), viz. "There is also the possibility that the AI worries that humans will open Pandora's box." It is cautioned that AI may invade virtual personal territory and pose a threat to data privacy. This raises ethical concerns that are inevitably to be overlooked in the current context such as social bots triggering intensified social arguments on many social media platforms and also the limitations of data quality, authenticity, and constructive conversations in some cases. The prime concern is about the issue of decision-making underpinned by ethical and legal issues and the prime question in the world of AI is "Who is to be held responsible for any mishap?" AI is just the means and not the end and global policies should strengthen and create space so that Humans and AI can both cordially coexist.

Intelligence and Problem Solving

The term 'Intelligence' itself can mean different things for different people, as can be seen from various definitions covering a broad range of views. Generally, various mental abilities are mentioned in connection to understanding the concept of intelligence, such as the ability to reason, think abstractly, learn quickly, learn from experience, solve problems, comprehend complex ideas, pattern recognition, creative thinking, etc. (Gottfredson, 1997; Patra, n.d.). Corroborating with this view, Snyderman and Rothman (1998) considered reasoning, problem-solving, and learning as crucial for intelligence., Colom, et. al. (2010) also defined intelligence as a "general mental ability for reasoning, problem-solving, and learning." The conclusion can therefore be made from these views, problem-solving is an important component of intelligence.

Some of these abilities associated with intelligence can also be seen in some animals, human intelligence is viewed as distinct, because of our capacity for reasoning, language, and abstract, reflective, and introspective thoughts and consciousness, among others. For thousands of years, we have tried to understand how we think and learn. This very existence of human intelligence is what enabled us to tip our toes into building "intelligent" machines, to consider it as a realm of possibility. And over the years, we significantly improved its effectiveness and efficiency as well, to the point that, as Buchanan (2005) pointed out, AI is not just about the mechanical programming of a machine anymore, but "understanding the nature of intelligent thought and action using computers as experimental devices."

Problem-solving is an important component of intelligence. This is also where the difference between humans and animals can also be seen. Humans are more capable of solving problems and eliminating barriers in their environment. Problems are a natural part of human life. Whether it's practical problems or intellectual problems, humans have long been dealing with them. Through time, we came up with various approaches for solving these problems. It can be said that Artificial Intelligence is also one such tool for solving problems. The concept of AI itself is associated with machines to help humankind solve problems and facilitate working processes (Tai, 2020).

One important concern in the philosophy of artificial intelligence is whether humans and other animals are best thought of as machines (like computational robots) themselves (Dietrich, E, n.d.). According to Russel and Norvig (2010), to say a program thinks like a human, it is necessary to determine how humans think, which may be done in three ways - through introspection, through psychological experiments, and brain imaging. If the program's input–output behavior matches corresponding human behavior, that is evidence that some of the program's mechanisms could also be operating in humans.

From the point of psychology, a problem might be defined as "a situation with an initial state, a goal state, and a set of possible intermediate states.", where one to be at one state (goal state) while he is at another state (initial state), with no obvious ways to reach the goal state. However, this concept may only apply to some problems and may not be relevant in others. Nonetheless, there are various strategies that humans use for solving problems, such as solving problems by

trial and error and solving problems with algorithms, as well as heuristics (Gray, Arnott-Hill, and Benson, 2020).

In computer science, problem-solving refers to artificial intelligence methods, "which may include formulating ensuring appropriate, using algorithms, and conducting root-cause analyses that identify reasonable solutions." Similar to humans, AI problem-solving involves the use of heuristics, and algorithms, in addition to polynomial and differential equations. It can come up with several solutions for the same issue **(**Problem Solving, n.d.)

Machine learning, which is currently the most popular technique of AI is an important AI function, where computers receive data and the answers expected from the data and, as a result, produce rules by identifying patterns between the two. (UNESCO, 2023). It automatically refines its methods and improves its results as it gets more data, thus essentially learning from itself by making use of past data. Examples can be the more advanced recommendation systems i.e., Google, YouTube, etc. Essentially, this may be compared to the way human babies learn to identify different things as they are being exposed more and more to different things in their environment. The definition of AI given by Kaplan and Haenlein (2018) "a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation also corroborates this concept.

Despite these similarities, it may be difficult to accept that machines can "think" like humans, as seen in Seale's Chinese Room Argument and Godel's Incompleteness Theorem. Also, as "intelligent" as a machine may be, it still suffers from inadequacies, it still needs humans to control it, it is hackable and can be misused, and can still make simple mistakes. So far, according to Kaplan and Haenlein (2018), even human-inspired AI and humanized AI still failed in other kinds of intelligence considered unique to humans, social intelligence and artistic creativity, respectively.

In the context of teaching and learning, problem-solving is used as a method to involve the students in the learning process, providing the students with ill-structured problems. By selecting appropriate problems and providing students with needed support and strategies, teachers can use problem-solving as a way to actively involve students in their learning. It is seen that AI in the field of education encourages more flexible learning solutions for students without minimal limitations. (Jain & Jain, 2019). In higher education around the world, especially in developed countries, AI is used for student acquisition, assessment, learning enhancement, student monitoring, tutoring and remediation, and various student affairs (Klutka, Ackerly, and Magda, 2018)

The Epistemological Under-pinning of Problem Solving

The foundation of the traditional education that we know of today generally came from an epistemology referred to as objectivism, positivism, or realism (Roth, 1993) or 'logical positivism' (Haworth & Conrad 1990) which viewed the nature of truth or knowledge as objective that exists "out there" to be discovered, independent of, and external to, the knower, and can be discovered through objective and empirical means. Objection to this perspective brings forth an epistemology that views truth as subjective (Haworth & Conrad 1990) and that knowledge is socially constructed (Emes & Cleveland-Innes 2003) which has led to a fresh perspective towards learning, teaching, and hence education in general. The progressive approach to education is one such example, and one major proponent of this approach is John Dewey (Ültanır 2012, Williams 2017) who described progressive education as "a product of discontent with traditional education" (Williams 2017). Criticism of the aforementioned epistemology has paved the way for the acceptance of constructivism as a viable alternative (Roth, 1993). A review of the literature suggested that the introduction of a problem-solving approach stemming from a constructivist or cognitive perspective is generally credited to the ideas of John Dewey, Jean Piaget, Vygotsky and Jerome Bruner (Casey & Howson 1993, Koohang, Riley & Smith 2009, Briggs 1963, Birch 1986, Herman 1995; Buchanan & Smith 1998, Slavin). According to Briggs (1963), problem-centered approaches are oriented in pragmatic philosophy.

The foundational theories which guide our perspective towards learning and instruction are ever-evolving and developing, and now leading education from the emphasis on behaviorist constructivist theories to cognitive constructivist approaches. This emergence of the constructivist perspective has changed educational methods from an emphasis on the delivery of instruction aimed at bringing about an observable change in behavior to the designing of learning activities based on cognitive processes, where "relevant, meaningful knowledge is created by the individual" (Tiligadas, 2018)

According to Savery and Duffy (1995), constructivism is a philosophical view on how we come to understand or know. Koohang, Riley & Smith (2009) defined constructivist learning theory as the "active construction of new knowledge based on a learner's prior experience". Ültanır (2012) concluded that a common theme from various definitions of constructivism is that it requires the learner to actively engage to develop an understanding of something. He also concluded constructivism as "a theory of knowledge and learning in which the individual "generates his or her knowledge" and "constructs knowledge in the process of tackling problems". Using the knowledge, experience, and understanding that the learners already have, they can make sense of or interpret new information and new situations – meaning that they construct their knowledge or meaning (Naylor & Keogh 1999, Scheurs & Dumbraveanu, 2014). It also emphasizes top-down instruction, meaning that students first work with complex problems and only later discover the basic skills required (Slavin, 1997).

John Dewey was credited as the person who showed how the problem method might be used, by choosing some problem which the students have felt involved in, and thereby making them active in the learning process. He also considered problem-solving through the methods of science, combined with reflective thinking. He observed that thoughtful but ordinary methods of solving problems have the same base features as those used by scientists and therefore placed great faith in scientific as well as ordinary methods of solving problems, referring to them by several names including 'reflective inquiry' (Briggs 1963, Briscoe & Stout 1996, Hiebert et al 1996). Briggs (1963) is also of the opinion that problem-solving requires higher processes and demands reflective thinking.

The terms reflective thinking or the reflective method were frequently used to designate a problem-solving approach based on Dewey's ideas. While there may be some variation in adaptations, a reflective method commonly contains psychological arousal and progressive systematic inquiry on the part of the learner. When students are confronted with something that "doesn't fit" with what they know, or something that produces some perplexity in them, the 'problem' can occur authentically (Maltorella, 1978). Merrill (2002) stated that the problem is defined in various ways by theorists. Some see it as 'engaging in some form of simulation of a device or situation'. While some merely see it as 'being involved in some form of real-world task' (Merrill 2002).

Using problems as a basis for learning is a good strategy to promote active learning. Problems serve as an effective starting point for learning because students face various problems in their daily lives anyway. How the problem is structured is also an important key to promoting active learning. While well-structured problems have a fixed correct solution as well as a particular process to arrive at that solution, ill-structured problems don't have either one. Choosing problems appropriate to the content and the learners' level is necessary to help build problem-solving skills (Tiligadas, 2018).

The problem-solving approach also gives importance to collaboration between the students. Problem-centered learning is enhanced by carefully structured peer interaction. While problem-centered learning is content-focused and peer-instruction is process-focused, both require active engagement on the part of learners, therefore when these two are combined, it leads to effective learning (Merrill & Gilbert 2008).

Problem Solving at the Heart of Artificial Intelligence

Epistemologically Problem-solving happens to occupy the heart of Artificial Intelligence. The roots and stem of the problem-solving method were nourished in objectivism, positivism or realism, and logical positivism. Developing thinking skills is deep-rooted in problem-solving methods, problem-based learning, critical thinking skills, creative thinking skills, decision-making, conceptualizing, and information processing (Ellis, 2005), very much part and parcel of the learning process. AI is an advanced technology of thinking machines, although a parallel doubt prevails on the ability of machines to think. AI is the advanced ability of an electronic circuit system to interpret data-based information, learn from such data, and use those learnings. Stephen Hawking once predicted that an increase in the level of the complexity of electronic circuits would supersede the evolutionary rate of increase in the complexity of the human brain, leading to an era where AI finds a comfortable scope and space (Rincon, 2018). Regardless of the progress made in the realm of AI, it is important that, as UNESCO pointed out, "AI technologies in education should be purposed to enhance human capacities and to protect human rights for effective human-machine collaboration in life, learning, and work, and sustainable development."

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Higher Education Institutions in Bharat to Set Significant Emphasis on Innovative Life Science Education Pedagogy

Kushagri Singh*

In India's higher education system, life science teaching pedagogy is crucial for a number of reasons, including the way it fosters in students the scientific temperament, curiosity, and inquiry skills that are essential for pursuing life science innovation and research. Along with being beneficial to the environment and society, it also helps students acquire values, knowledge, and skills that are critical to their own and professional growth. In the twenty-first century, students prepare for opportunities and challenges in biotechnology, bioinformatics, biomedicine, biosecurity, and ethics. Furthermore, it fosters interdisciplinary and transdisciplinary learning, which can enhance the comprehension and utilization of the biological sciences in a range of settings, such as business, academia, healthcare, agriculture, and many more [1].

Effective Pedagogies for Teaching Life Sciences

Which pedagogies could be used effectively in Indian higher education institutions to teach life science courses?

Many academics, educators, and politicians have examined and debated the pedagogy of life science education in India. Some of the most important components of Indian life science pedagogy are:

- STEM-based education: STEM education emphasizes the connections between science, technology, engineering, and mathematics as well as how these fields are applied to real-world issues. Students can enhance their critical thinking, creative, and problem-solving abilities as well as get ready for the global workforce of the future with the support of STEM-based teaching and learning.
- Discovery-led teaching: Discovery-led teaching is a pedagogy that encourages students to learn by doing, exploring, and experimenting with scientific phenomena. Discovery-led teaching can help students develop scientific attitudes, curiosity, and inquiry skills, as well as foster a deeper understanding of the concepts and processes of science.
- Reimagining the approach to learning: It is a pedagogy that questions established approaches to teaching and learning science, including textbook-based education, rote memorization, and teacher-centered classrooms. Students can interact with science in a more meaningful, relevant, and pleasurable way and gain a sense of ownership and responsibility for their learning by rethinking the way that science is taught [2-5].

Pedagogical Flaws

Which pedagogical flaws exist in the Indian teaching of life sciences?

The pedagogical flaws in India's life science education are numerous and intricate. Following are some typical difficulties:

- Lack of competent, driven, and experienced educators who can use cutting-edge techniques for instruction and evaluation;
- Lack of funding, infrastructure, and resources to support practical and experimental learning, particularly in rural and remote areas;
- Lack of integration and relevance of science curriculum with other subjects and real-world problems, which results in rote memorization and poor conceptual understanding; and
- Lack of confidence, interest, or involvement in science education among students as a result of a science phobia, perceived difficulty, or irrelevance [6-10].

Approaches to Address the Flaws

What approaches might be taken to address these pedagogical flaws?

The solutions to these problems are neither simple nor clear-cut; rather, they call for the combined efforts of many different parties, including the government, the educational system, parents, teachers, students, and society at large. Still, a few of the options include:

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- Enhancing the infrastructure, resources, and funding to support practical and experimental learning, particularly in rural and remote areas, by investing in laboratories, equipment, materials, and digital technologies.
- Improving the quantity and quality of teachers by giving them the necessary training, incentives, and support to use creative and effective methods of teaching and assessment.
- Including experts, educators, and students in the curriculum creation process to update and revise the scientific curriculum to make it more relevant to other courses and real-world issues.
- By utilizing inquiry-based, STEM-based, and discovery-led pedagogies, students' enthusiasm, engagement, and confidence in science learning will increase. Additionally, science will become more relatable, pleasurable, and accessible to all [11,12].

Challenges in the Implementation of Pedagogy

What are some challenges in the implementation of effective pedagogy for life science teaching in India?

Some of the challenges are:

- Limited inclusion of STEM in government-mandated degree programs and certifications for teachers.
- Inadequate and inefficient programs for retraining teachers.
- Insufficient funding to hire educators with the necessary qualifications.
- Inadequate money, infrastructure, and resources to promote hands-on and experimental learning, particularly in rural and isolated locations;
- A science curriculum that is not sufficiently integrated with other courses or relevant to real-world issues.
- Students' lack of interest, engagement, and confidence in scientific classes as a result of the subject's perceived difficulty, irrelevance, or phobia.
- Stereotypes and misconceptions about STEM fields that prevent students from participating [12].

Successful Examples of STEM-based Teaching in India

Some of the successful examples of STEM-based teaching in India are:

STEM Robo Technologies is an edtech company that offers robotics kits, online courses, and competitions as well as other STEM education solutions to schools and students. To encourage STEM learning among young innovators, the company has partnered with a number of government initiatives, including Atal Tinkering Labs and Atal Innovation Mission.

Another edtech company that provides STEM education programs to students in grades 6 through 12 is Deeksha STEM. These programs include coding, artificial intelligence, and data science. The company has developed and implemented STEM curriculum and assessments in partnership with the Central Board of Secondary Education (CBSE) and the National Council of Educational Research and Training (NCERT).

The government initiative known as Vigyan Jyoti seeks to enhance STEM opportunities for girls from underprivileged backgrounds. The program offers scholarships, mentoring, and encourages girls in grades 9 through 12 to seek higher education and employment in STEM subjects by providing them with career assistance and exposure visits.

Another government project, Vigyan Prasar, tries to get teachers and students interested in science by holding scientific fairs, science clubs, science movies, and science journals, among other events. In order to spread scientific knowledge and promote scientific literacy, the program also promotes the creation of digital and online platforms like India Science and Engage with Science [13-16].

Pedagogy Used by Worldclass Universities

Which life science pedagogy are top-tier world-class universities using?

The pedagogy employed in life science by elite universities is not homogeneous or standardized, as many establishments may possess distinct methodologies, objectives, and settings. Several characteristics of life science pedagogy that are shared among top-tier universities include:

- Inquiry-based learning, problem-based learning, and project-based learning are examples of active learning strategies that involve students in investigating, testing, and discovering scientific concepts and phenomena.
- Integration of interdisciplinary and transdisciplinary perspectives, such as STEM (Science, Technology, Engineering, and Mathematics), highlights the connections and applicability of life science to other disciplines and real-world problems.

- Assessment of learning outcomes, such as knowledge, skills, attitudes, and values, that reflect the students' understanding, application, and creativity [17].

Approaches to Elevate the Quality of Life Science Education

What approaches could be taken to elevate the quality of life science education in India?

There are many possible strategies to make life science teaching in India world-class, some of the common ones could be:

- Using cutting-edge teaching strategies that help increase students' engagement, meaning, and enjoyment of life science, such as role-playing, hands-on learning, storytelling, sports-based learning, and visual cues.
- Using student speaking, classroom debates, and instructional conversations to promote critical thinking, deeper learning, and feedback between students and teachers.
- Making use of online and digital resources that can improve the accessibility, content, and delivery of life science education, such as social media, science apps, and online courses.
- Raising both the number and quality of teachers by giving them the necessary tools, resources, and encouragement to employ cutting-edge, efficient teaching and assessment techniques.
- Improving the facilities, finances, and money to facilitate hands-on and experimental learning, particularly in rural and isolated places.
- Updating and modifying the life science curriculum to make it more pertinent to other courses and real-world issues.
- By utilizing inquiry-based, STEM-based, and discovery-led pedagogies, students' enthusiasm, engagement, and confidence in life science learning can be increased. Additionally, science can be made more inclusive and accessible to all students [17-20].

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Science : A Driver of Innovation

Gagandeep Kang (First Indian Woman Scientist to be elected as a Fellow of the Royal Society), Director, Enterics, Diagnostics, Genomics, and Epidemiology- Global Health, Bill and Melinda Gates Foundation delivered the Convocation Address at the 54th Convocation Ceremony of Indian Institute of Technology Delhi on August 12, 2023. She said, "Embrace challenges with curiosity, approach life with a scientific mindset, and let evidence and integrity guide your path. Remember that you have the power to shape a future that is not only technologically advanced but also compassionate, just, and more equitable than the world we have today. The challenges we face today are many and daunting, but with your education, intelligence, and passion for science, you are equipped to find solutions that will make the world a better place." Excerpts

This is such an exciting time for you─ years of hard work, struggle, highs and lows, good times, bad times, not knowing how you would do and persisting anyway, have brought you to this moment, where you are ready finally to step out into the world, armed with an education from one of the best institutions in India, and in the world. You are privileged, in the opportunities that you have created and that you have received. You are equipped with tools that will help you build your lives and change society.

Your Alma Mater is a Special Place. IIT Delhi's vision is to contribute to India and the world through excellence in scientific and technical education and research, to be a source of pride for all Indians, and to be a resource for society. In other words, you are called on to excel and to serve.

A little over 42 years ago, my father and I took a train from Delhi to Madras so that I could attend the interviews at the Christian Medical College, in Vellore. This institution has as its motto, 'Not to be ministered unto, but to minister'. In other words, to serve.

My father was in the Indian Railways, and both my grandfathers had worked for the government, before Independence, and the idea of pride in India and the need to be of service to our country was deeply ingrained in my family. Because of my father's transfers, I was without a domicile anywhere, so had no option but the colleges that did not have state-based reservations. Despite having traveled and moved around a lot, I had never been so far south before, and to see young girls in *pavadai*s, or half-sarees, and men in *lungis* was new to me since all of my school education had been in Bihar, UP, and Bengal. But I got to CMC, and stayed in the Women's Hostel, with some of the students who had agreed to beat interview candidates. I found that there were students from all over India, and despite the name of the college, there were plenty of others, who, like me, were not Christian. Over the three days of interviews conducted by the faculty and conversations with students at the hostel, I began to feel that despite it being so different from everything that I had grown up with, this was an institution that truly served our country.

I got into CMC and did my MBBS, and then an MD in Microbiology. CMC is an unusual medical college, it is a private unaided minority institution, but it was established to serve Indian women. In 1918, it began training Indian women in medicine, and men began to be admitted only in 1947. Students came from all over India and received a subsidized education so that they could return home and work in local hospitals.

In medicine, service is usually thought of as looking after patients, and solving their problems through medical management, or surgery. As you will recognize, there is a hierarchy in fields of specialisation you can imagine neurosurgeons and cardiovascular surgeons at the top of the field, and those who work in laboratories or teach the basic sciences, as being those who do not quite measure up to the idea of directly saving lives. With the deeply-ingrained motivation to serve, most of CMC's graduates choose clinical fields, and more than any other college I know of, a large proportion of graduates work in remote and rural locations. I chose differently, went into a diagnostic laboratory, and emerged from that to move even further from individual patients into research. When people think of medical research, what frequently comes to mind is oncology, neuroscience,

or genomics. My research was nowhere near these glamorous fields. I began to work on a problem that is common, that affects all of us at various times in our lives, but has the greatest impact on the poorest and most vulnerable amongst us the more discreet name is 'enteric infectious disease', but more bluntly. I have spent the last 32 years working on diarrhea in Indian children.

It has been an incredible journey, I have learned how difficult it is to accurately measure even a common disease, how little we know after decades of effort, the importance of bridging basic, applied, and translational science to solve problems, the critical need for teams and collaborations and of moving beyond science to policy and communication.

I have had the opportunity to work with the best scientists in India, including Dr. MK Bhan, who had a base at IIT Delhi and was the person who took forward the first vaccine developed in India. From my base at GMC, Vellore, 1 worked with the Government of India and with the World Health Organization and international research funders in the UK, the US, and Europe. We were learning from the communities we worked with, and the children who joined our studies before they were born, and applied it to try to mitigate the damage that resulted from diarrhea. We failed often, succeeded occasionally, and now I can look back and say that the vaccines we worked on saved about 30,000 children's lives in India every year. The hundreds of other people who worked on the vaccine and I have served.

These vaccines are now going to Africa and the Middle East and will likely be in Latin America mou. The work of Indian scientists and Indian companies provides tools that benefit the world. This is just one example of what is possible from a base in India.

You are stepping into the world equipped with the power of science and technology. Science has solutions to offer for many of the problems we face in society, and the privilege of receiving high-quality education and training from an esteemed institution like IIT Delhi comes with the responsibility to use your skills for service.

In the ever-evolving landscape of our world, science and technology have played an instrumental role in shaping human progress. From conquering diseases to exploring the cosmos, from communicating across borders to providing sustainable energy solutions, science has been a beacon of hope, a catalyst for change, and a driver of innovation. As graduates of the IIT, you are now part of this illustrious lineage that has changed the world for the better, and I am confident that you will find a way to be of service.

Next, I want to emphasise the importance of living your life according to the principles of science. The scientific method, with its emphasis on evidence-based inquiry and rigorous testing, is not just confined to laboratories and research papers; it can be a guiding philosophy for how we approach life's challenges.

First and foremost, never stop asking questions. The spirit of curiosity is what drives scientific progress. Approach every problem, be it personal or societal, with an inquisitive mind. Ask why things are the way they are, seek understanding and challenge assumptions. Embrace uncertainty, for it is the fertile ground from which discoveries emerge

In every aspect of your life, strive to generate evidence before making decisions. Avoid hasty judgments and baseless beliefs. Be open to different perspectives and be willing to adjust your views based on the evidence at hand. This approach not only leads to better decision-making but also promotes intellectual humility and growth. When we were conducting our studies on rotaviruses in the community, two vaccines were in development. Our findings indicated that one of the vaccines was unlikely to do what it was supposed to do, protect children from rotavirus diarrhea. We tried to present this information, but the scientific aristocracy at the time told the world that we were wrong. We approached our data in many different ways, but it always resulted in the same conclusion: that one vaccine strain would not work, so we stuck to our position and held out for four years of not being accepted by our professional community until we were finally vindicated. Standing up for science is not easy— but without it, we build on a foundation of sand.

Integrity is an indispensable trait in the pursuit of science and life. Let it guide your actions and decisions. Be honest; not just with others, but also with yourself. Admit your mistakes and learn from them. Remember that the pursuit of truth demands honesty, even when the truth is inconvenient or uncomfortable.

IIT Delhi has a long-standing tradition of producing outstanding alumni who have excelled in

various fields, making significant contributions to both India and the world. This culture of rigor, dedication, and pursuit of excellence has become the hallmark of an IIT graduate. As you enter the next phase of your life, hold onto this legacy of scientific culture and let it inspire you in all you do.

Finally, let us address a crucial aspect of personal and professional progress the necessity for engagement with diversity in contributions, diversity of gender, language or culture, or economic background. Historically, women and different societal groups have been underrepresented in STEM fields, and this needs to change.

Diversity Fosters Creativity and Leads to More Comprehensive Problem-solving

Biology and social constructs lead to the famous leaky pipeline, but looking back at my own research group, we have had plenty of weddings and babies. Flexibility was required, but among my students and colleagues who have become outstanding researchers in their own right, the women are as strong as the men. All we needed to do was to recognise that weeds differ just a little accommodation goes a long way and always pays off in the long run.

Science and humanism that acknowledges the criticality of diversity can be powerful allies in the quest for a better world. We must embrace evidence-based decision-making but also remember the importance of different views of the world and the human touch in all that we do. We must use our knowledge and expertise to address not only the technical challenges but also the human ones. The more dimensions we encounter, the wider our worldview and the clearer it is that empathy, kindness, and compassion are just as essential as equations and algorithms.

As we witness rapid advances in science and technology, we are presented with immense opportunities for good. The power of artificial intelligence, biotechnology, and renewable energy holds the potential to address pressing global challenges such as climate change, poverty, and disease. However, we must be wary of the digital and other divides that threaten to or do create inequity in society. The past few years have shown us the benefits of science and technology come most rapidly to those who have built strong foundations. India may not be a wealthy country.

But we have invested over decades in providing the resources to institutions of higher learning to ensure that we can provide world-class knowledge and training across a range of specialisations in STEM. As you move forward in your journey, embrace the responsibility that comes with your education. Remember that this is a gift from the people of India to you.

Carry with you these three thoughts: the importance of service, the scientific approach to life, and the crucial nature of diversity and empathy. They will give you the conviction to use your education for the greater good and build the spirit of science, the passion for inquiry, and the willingness and desire to work with and support inclusion.

Embrace challenges with curiosity, approach life with a scientific mindset, and let evidence and integrity guide your path. Remember that you have the power to shape a future that is not only technologically advanced but also compassionate, just, and more equitable than the world we have today.

The challenges we face today are many and daunting, but with your education, intelligence, and passion for science, you are equipped to find solutions that will make the world a better place. Congratulations, once again, and may you lead lives that make your *alma mater* and your country proud, and touch the hearts and souls of those you encounter along the way.

Jai Hind

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CAMPUS NEWS

National Seminar on Buddhist Educational Philosophy

A two-day National Seminar on 'Buddhist Educational Philosophy: Complex Challenges of the Modern World and Balanced Approach' was organized by the Department of B.Ed., CRDAMPG College, Gorakhpur in collaboration with the Government Buddha Museum, Gorakhpur, Uttar Pradesh from December 16-17, 2023. The event was sponsored by Sanskriti Vibhag, Uttar Pradesh. About 120 delegates including 40 participants from outstations, encompassing students, researchers, faculty members, and professionals participated in the event.

The Chief Guest, Professor Harikesh Singh, former Vice Chancellor, Jai Prakash University, Chhapra, Bihar inaugurated the event. The Welcome Address was delivered by the Vice Chancellor, Prof. Poonam Tandon who emphasized the relevance of Lord Buddha's teachings in today's context. Prof. Tandon highlighted the importance of imparting knowledge about the Buddhist tradition to children, underscoring that Buddhism transcends national boundaries. She reiterated Lord Buddha's emphasis on renouncing desire and attaining a state of freedom from suffering, emphasizing the purity that religion provides to life.

During the Inaugural Session, Professor Harikesh Singh delivered an enlightening speech, providing valuable insights into Lord Buddha's perspective on knowledge and wisdom. He delved into the teachings of *Heenyan, Mahayan,* and *Bajrayaan,* identifying contemporary challenges such as megalomania, presentism, and isolation. Prof. Singh emphasized '*Atma Deepo Bhav'* (Be your light) and the purification of the mind as the ultimate prosperity.

The event explored the moral disciplines (*Yama*) and observances (*Niyama*) as outlined by Lord Buddha. The Chief Guest and Keynote Speaker, Professor Dwarka Nath, former Head, Department of Philosophy, DDUGU, Gorakhpur emphasized the global significance of Mahatma Buddha. He underscored Buddha's departure from metaphysical focus, focusing on ethics, logic, and psychology. Prof. Nath characterized Buddha's philosophy as practical and morally grounded, citing the 'Eightfold Path' and 'Twelve Nidanas' as crucial for alleviating suffering.

Dr. Dharamvrat Tiwari, former Assistant Professor, Adult Education, DDUGU highlighted the contemporary issue of violence and stressed the importance of prioritizing the welfare of all living beings. Shri Pushp Dant Jain, Chairman, College Management Committee and Minister of State, urged the implementation of Buddha's teachings in everyday life. The inaugural function also featured the release of the book 'Different Dimensions of Yoga' by Dr. Ramchandra Tiwari. Dr. Yashwant Singh Rathore, Deputy Director of the Government Bauddha Museum, Gorakhpur, delivered the Vote of Thanks.

The Technical Session chaired by Prof. Rajesh Singh from the Education Faculty at DDU Gorakhpur University commenced with diverse paper presentations. Chief Speaker, Professor Vipula Dubey, former Head, Department of Ancient History, DDU Gorakhpur University emphasized the peaceful solutions offered by Buddha's philosophy to contemporary problems. Prof. Sarita Pandey chaired the next session and explored the caste system and the need for societal reform based on Buddha's teachings.

Dr. Ashutosh Kumar (Chief Speaker), Head, Department of Economics, Rajkiya Mahavidyalaya, Tihari, Gadhwal explained both theistic and atheistic philosophies. The session featured presentations on the relevance of Buddhist principles in modern education, the perspective of Buddhist philosophy in the context of NEP 2020 and understanding environmental ethics through Buddhist education. The next session commenced with a speech by Prof. Naresh Prasad Bhokta, former Head and Dean, Faculty of Education, DDUGU emphasizing the importance of adopting the middle path and the compassion inherent in Buddhist philosophy.

Additionally, Prof. Sushma Pandey Keynote Speaker, Education Faculty, DDUGU made

everyone aware of the essence of Mahatma Buddha's philosophy. She said that it is possible to attain '*Mahaparinirvana*' through good deeds and good thoughts. Prof. Brijesh Kumar Pandey, Principal, Ramji Sahay P G College, Deoria led the another session. He urged everyone to incorporate Mahatma Buddha's teachings into their behaviour. He elucidated that this philosophy, grounded in Buddha's guidance, underscores the significance of interrelationship, ethical conduct, and inner harmony as crucial pillars for overcoming present-day challenges. Additionally, Chief Speaker Prof. Ramesh Prasad Pathak, Lal Bahadur Shastri Rashtriya Sanskrit University explained the root causes of suffering and its prevention contained in the teachings of Mahatma Buddha. He said that a person should not acquire more things than necessary. Buddha's message is that '*Aatm Deepo Bhav'* or 'Be Your Light'.

The concluding session included the address by Dr. V Chandra Kaushik, Minister of State highlighting the need for improved guru-disciple relationships. The Chief Guest, Prof. Sanjeet Kumar Gupta, Vice Chancellor, Jannayak Chandrasekhar University, Ballia, Uttar Pradesh emphasized attaining *Nirvana* through meditation, knowledge, and discipline. Prof. Archana Mishra, Ratan Sen Degree College, Bansi, Siddhart Nagar explained the importance of education. She said that improvement of the society is possible with the coordination of intellectual and spiritual education. Mr. K D Tiwari, Head, Department of B.Ed, Baba Raghav Das PG College, Deoria. Prof. Umesh Yadav, Head, Department of B.Ed. President, Jawahar Lal Nehru PG College, Maharajganj. The Special Guest threw light on the life of Gautam Buddha. He said that one can get rid of the world only after attaining *Buddhatva*. Dr. Purnesh Narayan Singh, Head, Department of B.Ed. HRPG College, Khalilabad, Sant Kabir Nagar. He said that India has given us Buddha, not war. The Gautam Buddha has talked about non-violence in his philosophy. Non-violence does not mean cowardice but it means nurturing human religion.

Dr. Aparna Mishra, Head, Department of B.Ed., CRDAM PG College, Gorakhpur proposed the Vote of Thanks. He underscored the importance of Buddha's teachings in fostering a society based on intellectual and spiritual education. In conclusion, the event facilitated meaningful discussions among a diverse audience. The event addressed contemporary challenges and emphasized a balanced approach. With enlightening insights from various sessions, including discussions on moral disciplines, societal reform, and environmental ethics, the seminar provided a platform for intellectual exploration. The closing remarks highlighted the importance of improved guru-disciple relationships, resonating with the essence of Buddha's teachings.

Workshop on Immersive Technologies and Wearable Devices

The One-week Workshop on 'Immersive Technologies and Wearable Devices for Industrial and Engineering Applications' is being organized by the Department of Mechanical Engineering, National Institute of Technology Puducherry, Karaikal from March 04-10, 2024 in physical mode.

The industries in the manufacturing domain are experiencing substantial changes in functionalities with the arrival of emerging technologies in Industry 4.0. In the current context, industries are blooming to satisfy customer demands in terms of high-quality products, customized products, and mass production in minimum time. This has turned into a major challenge for all of the stakeholders to increase their level of perception, competency, and memory for quicker adoption throughout the full product life cycle management. In this context, the embracing of immersive technologies in the industrial environment enables the manufacturer to resolve the challenges with worker cognitive load. The Course Contents are:

- Creation of VR experience to explore different product designs in the virtual world.
- Creation of VR experience (animation) to insight into the assembly/ disassembly task involved in the production context.
- Modelling of simple geometries in the unity and tracking in the real context using Vuforia SDK.
- Creation of AR text instruction, annotations, and animations to execute the procedural task in the industrial context.
- Development of AR application to detect physical 3D objects in the real environment.
- Hand-on experience on holo lens exploration

For further details, contact Coordinators, Dr. J Ronald Aseer and/or Dr. MVA Raju Bahubalendruni, Assistant Professor, Mechanical Engineering, National Institute of Technology Puducherry-609609, E-mail: *ronaldaseer.j@nitpy.ac.in* and *mvaraju.b@nitpy.ac.in*. For updates, log on to*: www.nitpy.ac.in*

Workshop on Health System Costing

A two-day Workshop on 'Health System Costing' is being organized by the Health Technology Assessment Resource Center- ICMR, National Institute of Virology, Pune in collaboration with ICMR-National Institute for Research in Tuberculosis (NIRT), Chennai and ICMR-National Institute of Epidemiology (NIE), Chennai from February 06-07, 2024. About thirty participants will be allowed to participate in the event. It would be useful to researchers keeping an interest in understanding the concept of costing in healthcare and using this knowledge for undertaking costing studies in the future. Participants may learn how to plan a costing study and communicate the results. The Topics of the Events are:

- Health system costing: Introduction, need for cost data in healthcare decision making and role of HTAIn.
- Basic concepts costing: Classifications of cost, financial versus economic cost, normative versus actual cost.
- Methodology of costing: Costing perspective, time horizon for cost data collection and cost measurement approaches.
- Designing a costing study: Identification of cost centres, identification of outputs/ inputs, pricing and shared resources.
- Cost data collection and quality assurance: Steps to undertake cost data collection.
- Challenges in cost data collection in India: Institutional permission for data sharing, time for data collection, sources of primary data, unavailability of documented data, data sharing issues and possible ways to resolve the challenges in costing studies.
- Analysis of cost data-Part I: Dealing with joint/ shared cost, apportioning and capacity utilization statistics for various resources.
- Analysis of cost data- Part II: calculation of capital cost, annualization, discounting and recurrent cost calculation.
- Analysis of cost data-Part III: Sensitivity analysis & budget impact analysis
- Cost analysis of healthcare programs: Stages in costing a healthcare program & budget impact of the health programme.
- Hands-on exercise on calculation of discounting, annualization, and apportioning in costing studies.
- Cost of Illness analysis: Steps to undertake cost of illness analysis, study approach, cost components, and cost analysis of health risk.
- Applications of costing in HTA: Health system costing, Health program costing, Diagnostic and therapeutic procedure costing, etc.

For further details, contact Coordinator, Dr Yogesh K Gurav, Scientist F, Health Technology Assessment Resource Center, ICMR-National Institute of Virology, Pune, Maharashtra- 411001, Mobile No : 09822318278, E-mail: g*urav.yk@gov.in* and *htarc.icmr.niv2019@gmail.com*. For updates, log on to: *https://main.icmr.nic.in/workshops-conferences-seminars*

International Conference on Recent Advances of Probability and Statistics

A three-day International Conference on 'Recent Advances of Probability and Statistics in Interdisciplinary Research' is being jointly organized by the Department of Statistics, Faculty of Science, University of Allahabad, Prayagraj, Uttar Pradesh and Indian Society of Probability and Statistics from February 06-08, 2024. The objective of the vent is to bring academicians and researchers together from across the globe on a forum for discussion and dissemination of advanced ideas and principles in Probability and Statistics and its application in other disciplines like agriculture, medicine, epidemiology, social sciences, forestry, environment, etc. The Themes of the Event are:

- Probability Theory and Applications.
- Bayesian Statistical Inference.
- Time Series Analysis and Forecasting Models.
- Statistics in Quality, Reliability and Operation Research.

- Demography and Population Studies.
- Data Science Techniques.
- Statistics in Agricultural and Medicine.
- Environmental and Forestry Statistics.
- Bioinformatics / Bio-statistics / Survival Analysis.
- Survey Sampling.
- Planning and Experimental Designs.
- Statistics in Management.
- Econometrics.
- Deterministic and Stochastic Modelling.
- Applied Statistics.
- Univariate and Multivariate Analysis.

For further details, contact Organising Secretary, Department of Statistics, Faculty of Science, University of Allahabad, Prayagraj—211002 Uttar Pradesh. E-mail: *rapsir2024@allduniv.ac.in*. For updates, log on to: *https://allduniv.ac.in/faculties/statistics.*

AIU News

Capacity Building Programme on Enhancing Office Productivity

A three-day Short-term Capacity Building Programme on 'Enhancing Office Productivity: Microsoft Office and G-Suite Training' was jointly organized for non-teaching staff by the Association of Indian Universities─Academic and Administrative Centre, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore from September 30-October 02, 2023 through online mode. The inaugural day featured an illuminating session by Mr. Praveen Poulose E, Engineer from Quadrasystems.net India Pvt Ltd. on 'Microsoft Word and PowerPoint'. The session commenced with an introduction to Microsoft 365, emphasizing its cloud-based nature and accessibility across devices. Participants were guided through the historical context of Microsoft Office, its evolution into Microsoft 365, and the Key Applications: Word, Excel, PowerPoint, Outlook, OneDrive, and Teams. Mr. Praveen delved into Microsoft Word's pivotal role, offering insights into its practical applications, from document creation to resumes, notes, assignments, and legal documents. The session provided a comprehensive understanding of Word's interface, covering elements from the File tab to the Quick Access Toolbar. Each tab, including Home, Insert, Design, Layout, References, Mailings, Review, View, and Help was explored with practical examples. The training seamlessly transitioned to Microsoft PowerPoint emphasizing its prowess in creating impactful presentations. Five key topics were covered i.e. navigating the interface, creating engaging presentations, managing transitions and animations, creating charts, and rehearsing timings. A live demonstration showcased various PowerPoint features, including file management, inserting images, using slide transitions, and designing slides.

Mr. Thamizharasu C, Manager of Strategic Projects, Quadrasystems.net India Pvt Ltd. led the session on 'Microsoft Excel'. The session commenced with an in-depth overview of Excel's interface highlighting the significance of the Ribbon and the Options dialogue window. Participants gained insights into the Quick Access Toolbar, Formula Bar, Ribbon, Spreadsheet Grid, and Status Bar. The session emphasized Excel's adaptability and relevance across industries. Mr. Thamizharasu provided a comprehensive outlook of the Home tab, covering font formatting options and introducing the concept of worksheets and workbooks. Participants were introduced to vital keyboard shortcuts, enhancing efficiency in Excel operations.

The training explored various Excel features, including formatting data as a table, utilizing cell styles, inserting and deleting cells, rows, and columns. Participants learned about formatting cell size, row height, column width, and visibility options. Advanced topics such as organizing sheets, renaming them, applying tab colors, sorting, working with pivot tables, and creating charts were covered. Mr. Thamizharasu presented fundamental approaches to calculations in Excel: Formulas and Functions. Essential Excel formulas, including SUM, AVERAGE, COUNT, and TRIM were elucidated with real-time examples. The session concluded with

the emphasis on continuous learning and practice in Excel.

Ms Saraswathi P, Cloud Reign Technologies delved into Google Workspace applications. The first session focused on Google Meet, Gmail, and Google Calendar. Participants gained hands-on experience in leveraging Google Meet for virtual events and exploring advanced features in Gmail. Ms. Saraswathi covered creating teams in Gmail, utilizing Google Snippets for efficiency, scheduling messages, and exploring various settings options. The Google Calendar segment emphasized color-coding events, scheduling Google Meet links, enabling pop-up notifications, and scheduling meetings with unique codes. Participants learned to customize appointment schedules and set focus times for notifications. The second session centered on Google Drive, Docs, Sheets, Slides, and Forms. Ms. Saraswathi highlighted automatic saving in Google Docs, sharing documents as PDFs, and obtaining approvals for document edits. Participants explored Google Sheets capabilities, including tracking edits and email notifications for changes. The session introduced Google Docs' unique features, such as Explore options for inserting images and translating documents. The activity dashboard was showcased for monitoring document views and trends among team members. Ms. Saraswathi highlighted Google Sheets capabilities and the instant meeting start feature directly from Google Docs.

Dr. K Ramya, Programme Coordinator presented a comprehensive report lauding the effectiveness of the speakers and expressing gratitude for their valuable contributions. The report highlighted the programme's success in enhancing participants' skills, emphasizing the importance of adapting to technological advancements in fostering efficient workflows. The Programme was deemed immensely useful and timely in contributing to the professional growth of non-teaching staff. The collaborative effort of speakers, coordinators, and participants contributed to its effectiveness. The programme underscored the dynamic nature of office productivity tools and the importance of staying abreast of technological advancements.

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Samyak Prabodhan Sangh's
Bhimrao Pradhan College of Arts, Science, and Commerce,
Shahapur Dist. Thane - 421601
(Affiliated to University of Mumbai)

CORRIGENDUM

Reference to Advertisement No. University News 62 (02), January 08- 14, 2024 published in University News, the following Post reserved for are as following:

SC-04, ST-02, DT(A)-01, NT(B)-01, NT(C)-01, NT(D) - 01, OBC-05, EWS - 03, OPEN - 11.

Sd/-
SECRETARY

COMMUNICATION

Research: The Soul of Academics

Amarendra Pani* and Sistla Rama Devi Pani**

The words 'academic' and 'academia' which give pride to the higher education teaching and research community have an interesting origin. More interestingly, these words were not derived from anything related to education *per se*, which many of us may think. Here is a recount based on the facts provided in Wikipedia and some other websites on Plato which describes the origin of these celebrated words.

The words academic and academia originated from the name 'The Academy', a school started by popular Athenian Philosopher Plato, a mile or so outside the Athenian walls. The site can still be visited in modern Athens. However, the visitors may find it depressing to see that there are no interesting monuments or features there. The Academy got its name from its location, a grove of trees sacred to the hero Academus—or Hecademus. Academus (or Hecademus, Greek: Akademos or Hekademos) was an Attic hero, whose garden was selected by Plato for the place of his lectures. Hence, his disciples were called the "Academic sect."

The Academia was originally a public garden or grove in the suburbs of Athens, about six stadia from the city, named after Academus, who left it to the citizens for gymnastics. It was surrounded by a wall by Hipparchus, adorned with statues, temples, and sepulchers of illustrious men; planted with olive and plane trees, and watered by the Cephisus. Academus had owned the property in the time of Theseus, and the cult dedicated to him dates to at least the earliest years of the sixth century.

The term "Academeia" does not admit to the exact definition. Ancients used it not only to identify Platon's school but also the area enclosed by the precinct wall as well as the surrounding area. Originally, the land was arid, but the statesman Kimon made it into a well-watered grove, building running tracks and shady walks, and the original name for this entire region was Hekademeia.

The designation academy, as a school of philosophy, is usually applied not to Plato's immediate circle but to his successors. Legally, the school was a corporate body organized for the worship of the Muses, the 'scholarch' (or headmaster) being elected for life by a majority vote of the members. Most scholars infer, mainly from Plato's writings, that instruction originally included mathematics, dialectics, natural science, and preparation for statesmanship. The Academy continued until AD 529 when the emperor Justinian closed it.

The Academy philosophically underwent various phases, arbitrarily classified as follows: (1) the Old Academy, under Plato and his immediate successors as scholarchs, when the philosophic thought there was moral, speculative, and dogmatic, (2) the Middle Academy, begun by Arcesilaus (316/315-c. 241 BC), who introduced a nondogmatic scepticism, and (3) the New Academy, founded by Carneades (2nd century BC), which ended with the scholarch Antiochus of Ascalon (d. 68 BC), who effected a return to the dogmatism of the Old Academy. Thereafter, the Academy was a centre of Middle Platonism and Neoplatonism until it was closed in the 6th century AD.

Plato founded the Academy as an institute for the systematic pursuit of philosophical and scientific teaching and research. He presided over it for the rest of his life. The Academy's interests were not limited to philosophy in a narrow sense but also extended to the sciences: there is evidence that Plato encouraged research in such diverse disciplines as mathematics and rhetoric.

The Academy survived Plato's death. Though its interest in science waned and its philosophical orientation changed, it remained for two and a half centuries a focus of intellectual life. Its creation as a permanent society for prosecuting both humane and

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exact sciences has been regarded--with pardonable exaggeration--as the first establishment of a university. The site of the Academy was discovered by archaeologists in 1930. In 1997, the Greek Government announced the creation of an urban park running from the Acropolis, through the Agora, the Keramikos cemetery (Plato's apparent resting place), the columns of Olympian Zeus, and the Olympic stadium, all the way to the site of Plato's Academy.

With this humble beginning, the term Academic grew into a big concept having a world of its own, called the academic world. The academic world is a community of scholars and students who are involved in teaching, learning, and research. It includes universities and other institutions of higher education, as well as organizations dedicated to advancing knowledge in a specific field. Aspects, such as academic freedom, intellectual stimulation, etc., play different roles in different constructions of being an academic.

An ability to generate, analyse, disseminate, and exploit ideas is a crucial element in Academics. The task of generating knowledge is categorised as Research and the task of disseminating knowledge comes under teaching. Slowly, the Academics refined into a professional field and professionalization forced Academics to focus on achieving higher objectives. This resulted in resulted in the success *mantras* of a scholar, who explores the new areas of specialization. Continued pursuit of new areas of specialisation brought us to the juncture of the knowledge-driven world where society and the economy are dependent on knowledge systems.

Research entered the academic freehold and displayed its vibrant rhythms in the world of academics. It emerged as a quality-oriented central professional endeavour in academics, where every pursuit is best organized according to the discipline with a quest to address the problems and provide tangible solutions. It not only validates the truths and technological developments, finds multidimensional uses for these truths but also produces new knowledge in a way directly conditioned by possible applications. It shines the scholarship and is congruent with diversity, authenticity, appropriateness, and socio-economic purposefulness. To meet the growing demands of the globalized knowledge society, research acts as a powerful tool. Thus, Research acquires a prominent position in the world of Academics. It is perceived as the Soul of Academics.

Despite the wealth of literature on academic work, roles, and identities, the meaning of an academic is often not understood in the full sense by policymakers, educational administrators, and many a time by the academics themselves. Consequently, the treatment of academics is not as they deserve. There is therefore, a need for Policymakers as well as administrators of Higher Education Institutions to understand that the concept of academics goes beyond their defined physical roles in the discharge of their responsibility of molding the students into conscientious citizens and shaping the destiny of the country. It is also important for the Academics to understand and assert their role in terms of spirit as well as action. Lest they will be deprived of the deserved prestige.

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Theme/Subthemes for the Special Issue of University News-2023-24

S. No.	Zonal Vice Chancellors' Meet-2023-24	Theme/ Subthemes for Special Issue	Last Date to Contribute*	Date of Publication
1.	**North Zone**	**Globalization and Internationalization of Higher Education** *Subthemes* • International Collaborations and Partnerships: Building Bridges for Higher Education • Global Higher Education Policy and Regulation: Harmonizing Standards • Student Mobility and Diversity: Enhancing International Experience	January 31, 2024	February 12-18, 2024

*The Articles may be submitted to The Editor, University News, Association of Indian Universities, New Delhi through E-mail: *ramapani.universitynews@gmail.com* and *universitynews@aiu.ac.in* on or before the last date mentioned above.

THESES OF THE MONTH

HUMANITIES

A List of doctoral theses accepted by Indian Universities
(Notifications received in AIU during the month of Nov-Dec, 2023)

Geography

1. Das, Biswajit. **Geospatial based estimation of forest carbon dynamics and forest hydrology along the altitudinal gradients of Arunachal Himalaya**. (Prof. Santanu K Patnaik), Department of Geography, Rajiv Gandhi University, Itanagar.
2. Gogoi, Pranamee. **Channel instability and integrated flood management in lower Jiadhal River Basin of Dhemaji District, Assam**. (Prof. Santanu K Patnaik), Department of Geography, Rajiv Gandhi University, Itanagar.
3. Ojha, Vrinda. **Transformation of fringe area of Ahmedabad urban agglomeration: A geographical appraisal**. (Dr. Shital Shukla), Department of Geography, Gujarat University, Ahmedabad.

History

1. Bam, Mima. **The Galo and their neighbours: A study of the socio- economic and cultural development from past to present**. (Prof. Tana Showren), Department of History, Rajiv Gandhi University, Itanagar.
2. Basumatary, Bethuel. **Cultural assimilation of Bodo in Brahma Valley in the 20th century**. (Dr. Sudev Chandra Basumatary), Department of History, Bodoland University, Kokrajhar.
3. Patel, Bhavin Trikamlal. **Rise and growth of taxation system in India up to 1800**. (Dr. A K Singh), Department of History, Gujarat University, Ahmedabad.
4. Tikhak, Jeevantu. **The Tikhak Tangsa of Arunachal Pradesh: A study in socio-cultural dynamics of tradition and modernity up to 1987**. (Dr. Tajen Dabi and Prof. S K Singh), Department of History, Rajiv Gandhi University, Itanagar.

LANGUAGES & LITERATURE

Assamese

1. Gogoi, Rupam. **Vaijnyanik drishtibhangire Asomar Satriya sangaskriti: Ek adhyayan (Auniati Satra, Garmur Satra aru Barpeta Satrar bishesh ullikhanasaha)**. (Dr. Ratul Deka), Department of Assamese, Bodoland University, Kokrajhar.

Bodo

1. Baro, Maneswar. **A study on food habits and traditional knowledge system of the Bodos**. (Dr. Phukan Chandra Basumatary), Department of Bodo, Bodoland University, Kokrajhar.
2. Muchahary, Prasenjit. **Women representation in social folk customs of the Bodos**. (Dr. Phukan Chandra Basumatary), Department of Bodo, Bodoland University, Kokrajhar.

English

1. Baro, Gitanjali. **A study of cultural hybridity in Paulo Coelho's selected novels**. (Dr. Chandrima Sen), Department of English, Bodoland University, Kokrajhar.
2. Kisan, Jagtap Somnath. **Negotiations of dalit identity in Marathi theatre after the Dalit Panther Movement**. (Dr. Rajan Barrett), Department of English, M S University of Baroda, Vadodara.
3. Michichi, Ruth. **Saving the 'Endangered language' of Idu Mishimi: Constructing a Tri-lingual dictionary; (English-Idu Mishimi-Hindi) for improving Elementary School ESL learners' academic performance across the curriculum**. (Dr. K C Mishra), Department of English, Rajiv Gandhi University, Itanagar.
4. Naiya, Jigar Rajubhai. **Magic realism in select novels of Gabriel Garcia Marques and Alice Hoffman: A comparative study**. (Dr. Neerja A Gupta), Department of English, Gujarat University, Ahmedabad.
5. Noronha, D Shajan. **A semiotic analysis of urban youth culture in select Indian English novels**. (Dr. Nabamita Das), Department of English, Assam Don Bosco University, Guwahati, Assam.
6. Patel, Dhavalkumar Hasmukhbhai. **Reinterpreting history in the select works of Amitav Ghosh**. (Dr. Digvijaysinh Gohil), Department of English, Gujarat University, Ahmedabad.
7. Patel, Foramben Ashokbhai. **Man's deliverance of fate and chance: A critical study of Nihilism in the selected works of Ivan Turgenev**. (Dr. Rupal

Patel), Department of English, Gujarat University, Ahmedabad.

8. Patel, Ravindrakumar Mohanbhai. **Treatment of Catholic view in the dramatic works of T S Eliot**. (Dr. Sudhir Singh), Department of English, Gujarat University, Ahmedabad.

9. Shilpa Rani. **(Re) constructing identity: A study of Janet Mock's, Redefining Realness: My Path to Womanhood Identity, Love & so much, more, Deirdre McCloskey's Crossing: A Memoir, Laxminarayan Tripathi's Me Hijra, Me Laxmi and Living Smile Vidya's I am Vidya: A transgender's journey**. (Prof. Deepti Dharmani), Department of English and Foreign Languages, Chaudhary Devi Lal University, Sirsa.

10. Sukhwinder Kaur. **An analysis of ecofeminism in the select writings of contemporary Indian women writers**. (Dr. Mahesh Bhatt), Department of English, Gujarat University, Ahmedabad.

Gujarati

1. Kodiyatar, Najabhai Ghelabhai. **Sorathiya Rabari samajna prachin Arvachin lagna geetoan: Ek adhyayan**. (Dr. Virbhanbhai K Parmar), Department of Gujarati, Bhakta Kavi Narsinh Mehta University, Junagadh.

2. Popat, Bhavisha Bharatbhai. **Sarjak Jagdish Trivedina jeevan ane sahityama samajik Nisbat: Ek adhyayan**. (Dr. Virbhanbhai K Parmar), Department of Gujarati, Bhakta Kavi Narsinh Mehta University, Junagadh.

Hindi

1. Shrimali, Ravikumar Babubhai. **Vishnu Prabhaklar ke katha-sahitye mein samajik mulye**. (Dr. Girish Solanki), Department of Hindi, Saurashtra University, Rajkot.

2. Bajak, Hareshkumar Dhirubhai. **Dalit vaicharik parampara aur Omprakash Valmiki ka sahitye: Ek anusheelan**. (Dr. N T Gamit), Department of Hindi, Saurashtra University, Rajkot.

3. Kumari, Rani Renu. **Hindi alochana ko Vijendra Narayan Singh ka Pradey: Ek vishleshnatamak adhyayan**. (Dr. Pratibha Rajhans), Department of Hindi, T M Bhagalpur University, Bhagalpur.

4. Mer, Dhirabhai Boghabhai. **Dr Shankar Puntambekarji ke sahitye ka samikshnatamak adhyayan**. (Dr. Kamlesh C Desai), Department of Hindi, Saurashtra University, Rajkot.

5. Parghi, Rakesh Kantilal. **Hindi ke machuare jeevan kendrit upanyasoan ka samajik evam sanskritik adhyayan**. (Dr. Girish Solanki), Department of Hindi, Saurashtra University, Rajkot.

6. Pertin, Tokpet. **Malik Rajkumar ke gadya sahitya mein samajikta**. (Prof.Oken Lego), Department of Hindi, Rajiv Gandhi University, Itanagar.

7. Solanki, Kajal Bhimabhai. **Asghar Wajahat ke natakoan kee charitre srishti: Ek adhyayan**. (Dr. Pravinsinh R Chauhan), Department of Hindi, Saurashtra University, Rajkot.

8. Tank, Paresh Vallabhbhai. **Gujarat ke chayenit sahityekaroan ka Hindi kavita mein yogdan: Ek adhyayan**. (Dr. R M Rathod), Department of Hindi, Saurashtra University, Rajkot.

Nepali

1. Sharma, Kalyani. **Sanubhai Sharmaka Gadyarachanama vyangya chetna**. (Prof. M P Dahal), Department of Nepali, University of North Bengal, Darjeeling.

Sanskrit

1. Anuj Kumar. **Critical study of Sitaramiyam poetry**. (Dr. Sunita Gupta), Department of Sahitya, Central Sanskrit University, New Delhi.

2. Arya, Vikash. **Vaidik vangdmay mein pratibimbit Rashtra kee avdharna**. (Dr. Devendra Singh), Department of Sanskrit Language & Literature, Sanchi University of Buddhist-Indic Studies, Bhopal.

3. Bavaliya, Sonalben Mavajibhai. **Srinarendravijaymahakavy of Ambalal Prajapati: A study**. (Dr. Durga N Joshi), Department of Sanskrit, Saurashtra University, Rajkot.

4. Derasari, Sagar Gautambhai. **Development of the Pinda-Pitryajna of Suklayajurveda in the posterior classical Sanskrit literature and its importance in contemporary time**. (Dr. Parul M Mehta), Department of Sanskrit, Saurashtra University, Rajkot.

5. Gupta, Anshu. **A critical editing of the Matrikagrantha by Shri Ram Chandra Bhatta**. (Prof. Bhagwati Sudesh), Department of Dharamashastra, Central Sanskrit University, New Delhi.

6. Janhvi Shukla. **Editing and study of a classical musical text called Shivagitam**. (Prof. Lalit Kumar Tripathy), Department of Sahitya, Central Sanskrit University, New Delhi.

7. Lodha, Rahul. **Amarchandrasoorivirachita-kavyakalpalatayah sampadanam sameekshanan-**

cha. (Prof. Harinarayan Tiwari), Department of Sahitya, Central Sanskrit University, New Delhi.

8. Maiyad, Vaishaliben Dhirubhai. **A critical study of Pancamahabhutas in the context of environment in Bhasanatakacakra**. (Dr. R B Solanki), Department of Sanskrit, Saurashtra University, Rajkot.

9. Makwana, Jyoti Keshubhai. **A comparative: study: of sahityadarpana of visvanatha and Kavyalankarakarika of Rewaprasad Dwivedi**. (Dr. B J Solanki), Department of Sanskrit, Saurashtra University, Rajkot.

10. Mondal, Ashok. **A critical study of Shivarajavijaya in the view of Paniniyavakaranam**. (Prof. Harekrushna Mohapatra), Department of Sahitya, Central Sanskrit University, New Delhi.

11. Pratigya Devi. **A critical study of the drama Aanandaraghunandana by Shrimadvishwanatha Singh Judeva**. (Prof. Vishvambhar Nath Giri), Department of Sahitya, Central Sanskrit University, New Delhi.

12. Renu. **Manjeertika-matrikagranthasya sameekshatmakam sampadanam**. (Prof. Vasudev Sharma), Department of Jyotisha, Central Sanskrit University, New Delhi.

13. Sanjeev Kumar. **Analytical study of shapes of constellations in respect of East and West**. (Prof. P V B Subrahamanyam), Department of Jyothisha, Central Sanskrit University, New Delhi.

14. Sarita Kumari. **Ratnavali Priyadarshika natikayostustulnatamakmadhyayanam**. (Dr. Renuka Sinha Pracharya), Department of Sanskrit, Kameshwara Singh Darbhanga Sanskrit University, Darbhanga.

15. Sharma, Arun. **The contribution of Acharya Achyutananda Dash in the development of Sanskrit**. (Prof. Dharmendra Kumar Singhdeo), Department of Sahitya, Central Sanskrit University, New Delhi.

16. Sharma, Pankaj Kumar. **An editing of Dipikatika of Vajasaneya pratishakhya and its study in the light of Paninian grammar**. (Prof. Lalit Kumar Tripathy), Department of Navya Vyakarna, Central Sanskrit University, New Delhi.

17. Sharma, Sachin. **A critical linguistic study of Vajasney pratishakhya with reference to orthography and phonetics**. (Prof. Ashok Chandra Gaur Shastri), Department of Vyakarna, Central Sanskrit University, New Delhi.

18. Uniyal, Sandeep. **A comparative study of Kaviraja's Rasamakaranda and Vidyarama's Rasdeerghika**. (Prof. Shishir Kumar Pandey), Department of Sahitya, Central Sanskrit University, New Delhi.

19. Vehera, Shiv Prasad. **Kuvalyananadalankarmaniharyoah tunatamakam adhyayanam** (Dr. Renuka Sinha), Department of Sanskrit, Kameshwara Singh Darbhanga Sanskrit University, Darbhanga. D.Lit.

20. Vihol, Hitendrasinh Dasharathsinh. **A critical study of Bharavi's Arts of Syntax**. (Dr. M D Savsani), Department of Sanskrit, Saurashtra University, Rajkot.

21. Yadav, Pooja. **Review study of Stutikusumamala written by Pandit Premnarayan Dwivedi**. (Dr. Pradeep Kumar Pandey), Department of Sahitya, Central Sanskrit University, New Delhi.

PERFORMING ARTS

Painting

1. Sagar, Pratik. **A critical study of painting in healing practices: Art as therapy with special reference to Thangka paintings**. (Dr. Susmita Nandi), Department of Indian Painting, Sanchi University of Buddhist-Indic Studies, Bhopal.

Philosophy

1. Haldar, Buddhiswar. **The justification of human existence (Satta): A socio-ethical perspective**. (Prof. R N Ghosh), Department of Philosophy, University of North Bengal, Darjeeling.

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Kuriakose Elias College, Mannanam
Mannanam P.O., Kottayam-686561
Assistant Professor Vacancy- Re-Notification

Applications are invited from persons with hearing disability for appointment as Assistant Professor in Psychology (1 vacancy) in Kuriakose Elias College, Mannanam against a permanent vacancy as per clause 34 (1) of the Rights of the Persons with Disabilities Act 2016, G.O. (Ms)No.96/2021/H. Edn. dated 15.02.2021 and G.O.(Ms)No.242/2022/H.Edn. dated 18.05.2022. In the absence of candidates with hearing disability, provisions for rotations in G.O.(Ms)No.242/2022/H. Edn dated 18.05.2022 will become operative to the next categories of disabilities, in the order of priority and will be called for interview. Therefore, those with other disabilities are also invited to apply for the post. Qualifications, age and scale of pay will be as per UGC/Government/University norms. Application form can be obtained by sending a request to the Principal. The duly filled in application along with the copies of the supporting documents is to be sent to The Principal, K. E. College Mannanam, Mannanam P.O., Kottayam-686561, by registered post **within 30 days** of this notification. Phone: 8590704501, **Email: kecollegemnm@gmail.com.**

Mannanam — Sd/-
09-01-2024 — **Manager**

ANJUMAN-I-ISLAM'S
AKBAR PEERBHOY COLLEGE OF EDUCATION
Plot No. 15, Sector – 10/A, Vashi, Navi Mumbai
MINORITY INSTITUTIONS
APPLICATIONS ARE INVITED FOR THE FOLLOWING POSTS
FROM THE ACADEMIC YEAR 2023-24

UNAIDED

Sr. No.	Cadre	Subject	Total No. of Posts	Post Reserved for
1.	**Assistant Professor**	Education	2	2-OPEN
2.	**Librarian**	---	1	1-OPEN

The above posts are open to all, however candidates from any category can apply for the post.

Reservation for women will be as per **University Circular No. BCC/16/74/1998 dated 10th March 1998 4% reservation shall be for the persons with disability as per University Circular No. Special Cell/ICC/2019 – 20/05 dated 05th July, 2019.**

Candidates having knowledge of Marathi will be preferred.

"Qualification, Pay-Scales and other requirement are as prescribed by the UGC Notification dated 18th July, 2018, Government of Maharashtra Resolution No. Misc-2018/C.R.56/18/UNI-1, dated 08th March, 2019 and University Circular No. TAAS/(CT)/ICD/2018-19/1241, dated 26th March, 2019 & revised from time to time".

The Government Resolution and Circular are available on the website: mu.ac.in.

Applicants who are already employed must send their application through proper channel. Applicants are required to account for breaks, if any in their academic career.

Application with full details should reach the HON. GENERAL SECRETARY, ANJUMAN-I-ISLAM, PLOT NO. 15, SECTOR 10/ A, VASHI, NAVI MUMBAI – 400 703. within 15 days from the date of publication of this advertisement. **This is University approved advertisement.**

Sd/-
HON. GENERAL SECRETARY

MAHARSHI VIVEKANAND SAMAJKALYAN SANSTHA'S
MATOSHRI GURUBASAVVA KALYANSHETTI ARTS & COMMERCE MAHILA MAHAVIDYALAYA, AKKALKOT DIST., SOLAPUR

MINORITY COLLEGE

Email : gurumahila@rediffmail.com

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

UNAIDED (MINORITY)

Applications are invited from eligible candidates for the following Posts on **Permanent Non-Grant Basis:**

Sr. No.	Designation	Total Vacant Posts
01	**Principal**	01
02	**Librarian**	01
03	**Asst. Professor (Economics)**	01
04	**Physical Director**	01
	Total Post	**04**

Instructions :-

1) Open posts are open to all, however candidates from any category can apply for the post.
2) Educational Qualification and other requirements are as prescribed by the UGC Notification dtd. 18th July 2018, Govt. of Maharashtra Resolution No. Misc-2018/C.R.56/18UNI-1 dts. 8th March 2019 and University Circular No. PAHSUS/ Estt/7th pay/2019/2285/ dtd. 25th March 2019.
3) Candidates should submit their Academic Research Score (Academic Performance Indicator) report with related documents. (Only for the post of Principal).
4) A relaxation of 5% shall be allowed at the Bachelor's as well as at the Master's level for the candidates belonging to SC/ ST/OBC (Non-Creamy Layer) Differently-abled for the purpose of eligibility and assessing good academic record for direct recruitment.
5) Reserved Category candidates, who are domiciled out of Maharashtra State, will be treated as open Category candidates.
6) Reserved Category candidates should also to send a copy of their application to the Deputy Registrar, Special Cell, Punyashlok Ahilyadevi Holkar Solapur University, Solapur.
7) Application Received after the last date will not be considered. The College will not be responsible for postal delay, if any.
8) Reservation for PWD, Women and Disabled persons will be as per the Govt. norms.
9) Reserved category candidates shall produce the Caste Validity Certificate as per the directives issued by the State Government vide Circular No. BCC-201/Pra. Kra. 1064/2011/16B dated 12-12-2011.
10) Reserved category candidates (except SC/ST) shall produce Non-Creamy Layer Certificate at the time of interview.
11) Reservation for VJNT Categories is internally transferable.
12) Applicants who are in service must send their application through proper channel.
13) Applicants are required to account for breaks if any, in their academic career.
14) T.A. D.A. will not be paid for attending the interview.
15) Applications with full details should reach through the channel Secretary, Maharshi Vivevanand Samajkalyan Sanstha, Akkalkot **within 30 days** from the date of publication of this advertisement.
16) Incomplete application will not be entertained.
17) All the Terms & conditions are applicable as mentioned in the NOC letter No. JDHESolapur/NOC/2019/3 dated 17.01.2023 from Hon. Deputy Secretary, Higher and Technical Education Dept., Govt. of Maharashtra, Mumbai and letter No. DJD/HESDS/2023/138 dated 24.01.2023, Hon. Deputy Director of Higher Education, Solapur Division, Solapur.
18) All the terms & conditions are applicable as mentioned in the GR dated 12.11.2021 from Higher and Technical Education Department of Government of Maharashtra.
19) Please note that the recruitment procedure initiated by this advertisement is subject to the decision by Hon. Bombay High-court, Aurangabad Bench in WRit Petition No. 12051/2015.
20) This is University approved advertisement.

Secretary
MAHARSHI VIVEKANAND
SAMAJKALYAN SANSTHAS
AKKALKOT

Yuvak Vikas Shikshan Prasarak Mandal, Pimpaldari

College of Education (B.Ed.), Gangakhed,

Tq. Gangakhed, Dist. Parbhani (Maharashtra)

WANTED

Applications are invited form the eligible candidates for the Post of **Assistant Professor** full time in **Y.V.S.P.M. College of Education (B.Ed.) Gangakhed (Permanent Non Granted).** Applications should reach the undersigned **within Fifteen days** along with essential true copy of documents from the date of publication of this advertisement at the college address by Registered post only. Candidate from Reserved Category send one copy of their application to **Assistant Registrar, Special Cell, Swami Ramanand Teerth M. University, Nanded.**

Sr. No	Position	No. of Post	Reservation
01	Perspective in Education	04	Open -5 SC-2, ST-1 VJ (A)-1 NT (C)-1 OBC-3 EWS-1
02	Pedagogy Subjects (Maths, Science, Social Science, Lang.)	08	
03	Health & Physical Education	01	
04	Performing Arts (Music/Dance/ Theatre) Fine Arts	01	

Educational Qualifications as per UGC & NCTE Regulation-2014:

A) Perspectives in Education or Foundation Courses:

i) A Master's Degree in Social Science with 55% marks (or an equivalent grade in a point scale wherever grading system is followed), ii) M.Ed, with at least minimum 55% marks (or an equivalent grade in a point scale wherever grading system is followed); and, iii) SET/ NET/ Ph.D. in Education.

OR

i) M.A. in Education with minimum 55% marks (or an equivalent grade in a point scale wherever grading system is followed), ii) B.Ed./B.El.Ed. with at least minimum 55% (or an equivalent grade in a point scale wherever grading system is followed), and, iii) SET/NET/ Ph.D. in Education.

B) Curriculum Courses and Pedagogy Subjects:

i) A Master's Degree in Mathematics/Science/Social Science/Languages subject with 55% marks (or an equivalent grade in point scale wherever grading system is followed), ii) M.Ed. /M.A. Education Degree with at least minimum 55% Marks (or an equivalent grade in a point scale wherever grading system is followed); and, iii) SET/NET/ Ph.D. in Education.

C) Health and Physical Education:

i) A Master Degree in Physical Education (M.P.Ed) with minimum 55% marks (Training/ Qualification in Yoga Education shall be desirable) , ii) SET/NET/ Ph.D. in Physical Education.

D) Performing Arts (Music / Dance / Theatre) Fine Arts:

i) Post Graduate Degree in Music/Dance/Theatre/Fine Arts (MFA) with 55% marks., ii) SET/ NET/Ph.D. in Performing Arts & Fine Arts,

Salary & Allowances: Pay Scales as per UGC, State Govt. & S.R.T.M. University's rules from time to time.

Note: 1) Prescribed application form is available on the University website (www.srtmun.ac.in) 2) No T.A/D.A will be paid to attend the interview. 3) There will be Relaxation of 5% Marks at P.G. Level for SC/ST candidates only. 4) According to Govt. rules 30% and 3% posts will be reserved for women and differently abled persons respectively. 5) Eligible candidates those who are already in services should submit their applications though proper channel. 6) All attested Xerox Copies of certificates and other relevant document should be attached to the application form.

Address for correspondence

Yuvak Vikas Shikshan Prasarak Mandal, Pimpaldari

College of Education (B.Ed.), Gangakhed, Tq. Gangakhed, Dist. Parbhani (Maharashtra)

Pin 431514 Mob.No.8806611100

President
Y.V.S.P.M. Pimpaldari

Principal
Y.V.S.P.M. College of Education (B.Ed.) Gangakhed

Announcement
Special Issue of 'University News'

A **Special Number of the University News** on the theme ***'Higher Education@2047'*** is being brought out in the Month of March, 2024.

The **Special Issue** will cover the articles of eminent educationists on the afore-mentioned theme. Readers of the University News are also invited to contribute to the Special Number by submitting papers/articles on the above theme by **March 01, 2024**. The papers will be published in the Issue subject to the approval of the Editorial Committee of the University News. The contributions are invited on the following Subthemes:

Digital Transformation in Higher Education

- The Future of Credentialling: Digital badges, Micro-credentialing and Online Degree
- AI and Analytics in Higher Education: Transforming Decision Making
- Faculty Development and Digital Pedagogies: Empowering Educators

Integrating Bhartiya Knowledge System (BKS) with Higher Education

- Using Bhartiya Knowledge System-based Approach for Teaching-learning for Holistic Development.
- Bhartiya Knowledge System in Sustainable Development.
- Embedding Bhartiya Knowledge System for Futuristic Education.
- Ancient Bharatiya Wisdom in Modern Context: Everlasting Relevance of Indian Knowledge System Heritage for Human Development.
- Return of the Vishwa Guru Status: Strategies to Maintain and Propagate Ancient Indian Wisdom for Global Welfare.
- Embedding Indian Traditional Knowledge into Advanced Scientific Research and Futuristic Technology to Optimise the Advantages.
- Traditional Tribal Knowledge Treasure in India: How to Make Best Use of.
- Challenges in Communication and Dissemination of Traditional Knowledge.

Future of Work and Skill Development

- Sustainable Careers: Navigating a Dynamic Workplace.
- Human-centered Skills in a Tech-driven World: Soft Skills and Emotional Intelligence.
- Resilience & Adaptability: Impact of Gig Economy on Higher Education.

Nurturing Research and Innovation Ecosystem

- Collaborative Research Networks: Fostering Interdisciplinary Research.
- Entrepreneurship and Innovation: From Idea to Impact.
- Innovative Funding Models for Research.

Globalization and Internationalization of Higher Education

- International Collaborations and Partnerships: Building Bridges for Higher Education.
- Global Higher Education Policy and Regulation: Harmonizing Standards.
- Student Mobility and Diversity: Enhancing International Experience.

Any Other Relevant Subthemes

Guidelines for contributors are placed on the AIU Website. Manuscripts may be sent to the Editor, University News, Association of Indian Universities, AIU House, 16 Comrade Indrajit Gupta Marg (Kotla Marg), New Delhi- 110 002 through E-mail: ***ramapani.universitynews@gmail.com*** with a copy to: ***universitynews@aiu.ac.in*** on or before **March 01, 2024.**

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