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Comprehensive National Proficiency Score: An Organic Metric to Assess Universities

R Jaishanker*

Aranmula Kannadi (mirror) is a hand-crafted product that can hardly be matched by competing merchandise fabricated in the finest factories. The cottage industries where these mirrors are made are neither Six Sigma certified nor have any ISO standards. Nevertheless, their products are in a peerless class (Srinivasan, 2016).

The *Aranmula* mirror is one example in the long list of hand-crafted products from across the world, which silently testify that internal process refinement does not guarantee the quality of the final product. They illustrate the importance of craftsmanship and age-old wisdom. Administrators and managers know that process and product assessment are two different entities. Both contribute to the ultimate objective of any enterprise. The returns on investment in the former reduce unwanted use of resources and optimise the efficiency of each sub-process within. On the other hand, focusing on the product requires walking along the known path with less scope for experimentation and innovation. Both approaches have their pros and cons.

With the corporatisation of academia in India, the process-focused approach has garnered more ayes than the product-focused approach. But for a thin layer of elite students, the process-focused approach, especially at the undergraduate level in India, is ahead of time equally for the taught and the teacher. In the race to meet the rating criteria, 'corporate academic' institutions lose out on the opportunity cost by investing heavily in paraphernalia and digitisation, which could otherwise have been invested in the students. The crux of the bane that impedes academic excellence lies in promoting undergraduate education as a business proposition under a regulatory framework that disproportionately encourages institutional ratings over graduate student ratings.

The prevailing assessment system of Indian educational institutions puts the cart before the horse. Rating of universities in India as carried out now is 'process-centric'. It considers several parameters for institutional infrastructure, faculty education level, proficiency, curricular processes, and co-curricular activities. However, significantly less weightage is given to the quality of graduating students. Hence, the rating scores obtained do not reflect the actual ground reality. Engineers who graduated from high-rated institutions/ universities lining up for fourth-grade appointments (*https:// timesofindia.indiatimes.com/city/kochi/engineers-line-up-for-cycle-*

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test-to-become-peons/articleshow/104765451.cms) speak volumes about the efficacy of our institutional assessment system. The following analogy will help to clarify the disconnect between the rating scores of academic institutions and reality. Consider an automobile manufacturing company 'A' that strictly adheres to all internal process quality metrics to produce a model that does not get wide public acceptance. Another company, 'B', which falls short in operational efficiency, comes out with its model that is a roaring success. As in the case of *Aranmula*, mirror or company 'B', underrated academic institutions also produce quality graduates. It is possible because of the craftsmanship of the teacher.

There are exceptionally brilliant teachers spread across different Universities/ colleges in India. However, students, influenced by the rating metrics, fail to discover them. It would be prudent to rework the existing university/ college assessment system to find the hidden talent pool of teachers and magnify their contribution. Adopting a national graduate student-based rating system for academic institutions is an organic means to discover the latent pool of teachers. The following lines outline a pragmatic and transparent approach to assessing higher education institutions.

> The prevailing processes-centric assessment system of Indian educational institutions puts the cart before the horse.
>
> The author puts forth an organic, product-centric metric to assess academic institutions and universities in India.
>
> The weighted average of the CNPS of students across the various departments of any university is a good metric to rate the university.

A Comprehensive National Proficiency Score (CNPS) should be included as a mandatory, non-credited pre-requisite for all disciplines. Students graduating from any Indian university should produce CNPS to demonstrate their subject knowledge, practical skills, and innovation quotient. A youngster without CNPS should not be reckoned as a graduate. CNPS will render the disparate marking schemes practised in different universities redundant and rank all students. Superficially, CNPS resembles the Graduate Aptitude Test in Engineering (GATE) score. However, unlike the GATE score that is primarily used for postgraduate admissions, CNPS is proposed as a mandatory requirement to be considered a graduate.

The weighted average of the CNPS of students across the various departments of any university constitutes an organic metric to rate the university. The CNPS-based rating of academic institutions will reflect the ground reality better. The comprehensive national assessment process should be scheduled at such a time that all students graduating from any Indian university will be able to take it in the same calendar year. All candidates who appear for the comprehensive national proficiency assessment will get a score. The option of multiple chances should not be encouraged. In the event any candidate opts for a second or deferred attempt, the CNPS secured during the passing out year should only be considered for institutional rating. Besides being an organic and transparent metric for institutional rating, CNPS will help prospective employers to narrow down to 'employable graduates' from the stack, bury the 'crafted public perspective' of institutions, and deflate misleading placement statistics. On the other side, academicians will become objectively accountable. Over time, excellent teachers who remain unnoticed will be highlighted. CNPS does not come in the way of institutionalising relevant educational processes implemented within academic institutions. It looks only at the quality of the graduating student.

Sub-optimal efficiency in academia constricts the future of our collective national aspiration. Implemented transparently and inclusively, CNPS is a panacea that simultaneously addresses the challenge of enhancing student competency and faculty and institutional quality. Like any other constrictive idea, CNPS, too, will not go unchallenged. The author believes that criticism is the fuel to take wings. The possibilities unveiled by emergent technologies will help override almost all challenges raised against CNPS, except the resolve to improve the quality of Indian graduates.

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Higher Education in India and the Demographic Dividend

G Gopalakrishnan*

The present paper highlights some of the urgent problems that could face developing countries in the coming years of inflation, unemployment, and political idiosyncrasies! Though the demographic dividend definitely supports the Indian perspectives, equally are the serious problems that we may have to face – the GER (Gross Enrollment Ratio) of youth in the age group 18-23, which now stands at 27.3, needs to be considerably stepped up. The general statistics state that 70% of India resides in rural areas! This implies up-skilling of the rural youth may tend to become a problem unless some serious views are taken and programmes are started in the rural parts of India. Another problem being dealt with is the diverse dialects existing among the Indian Diasporas! Perhaps the new NEP- 2020 (National Education Policy- 2020) may take care of this by the tri-lingual formula being adopted by the Government of India for the schools, in the primary stages. Another problem could be, battling with the improvements in technologies being introduced by the advanced countries – which implies, we need to step up research and innovation in the HEIs (Higher Educational and Research Institutes).

It therefore becomes imperative for India to be able to generate considerable employment opportunities for the working-age population. Secondly, India would not be able to take advantage of the opportunities, because of a lack of skills and a low human capital base. Taking into consideration the growth of the Indian economy, it may not be in a position to handle the demographic transition. Unless the GER is increased and the working-age population is skilled enough to face the developments, it would be a gigantic task to take advantage of the demographic dividend, from which India could greatly benefit.

Introduction

Diverse Speaking Habits of the Population – Dialects

Right through the ages, India has been at the forefront of education – Vedic, Brahmanical, Muslim, British - and has seen through diverse aspects due to the various invasions India had been subjected to. Definitely, the best that we had was through the British giving us a language - English – which still works as a substitute for a 'Rashtra Basha'!

The 2018 Official Census of India indicated that 19500 languages or dialects are spoken as mother tongues in India. 121 languages are spoken by 10,000 or more people. It has also been indicated that 96.71% of the population of the 1.21 crore people at that time had one of the 22 scheduled languages as their mother tongue. This had been a major hindrance in arriving at a single unified language as media of instruction, right across the country.

Current HEIs and Central Research Laboratories

In India, there are at the moment 1,113 Universities, 43,796 Colleges, and 149 Institutes of National Importance, with about 4.4 crore students in attendance. 43% of the Universities and 61.4% of the colleges are in the rural areas. There are 23 IITs (Indian Institutes of Technology) in India and recognized as National Institutes of Importance by an Act of Parliament in 1961. Apart from the above, 216 Research Institutes under various categories like Agriculture, Chemical, Biological and Medical, Physical and Mathematical, Engineering, Earth Sciences, Material, Metallurgy and Minerals, and Multi-disciplinary have been established across the various States of India.

Demographic Dividend – Concerns

India's population has crossed 1.44 billion having surpassed mainland China to become the world's most populous country, according to UN estimates. The median age in India is 28.4 years, according to Worldometer, which in contrast compares with 38.3 years in the US, 38.4 years in China, 40 years in Japan, and 40.5 years in the UK; the main advantage of the young working-age population is that young people adapt fast and can keep pace with the constant technological changes. India's working-age population (people between 15 and 64 years of age) has expanded more than the non-working-age population — people aged 14 years or below and above 65 years of age. By 2040, India should be having a

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large working population! "Populations cannot be the only redeeming strength of countries in the South and South East Asia, including India, and they would need to focus on education and infra to take advantage of the demographic dividend" according to the latest report by Moody's Investor Service. 'Regions need to take advantage of the opportunities to enhance long-term economic growth' – Moody's.

The following perhaps needs to be looked into:

- Lack of appropriate skills – India ranks 130th of 180 countries in the UNDP Human Development Index- which implies that the education levels and health provisions need to be substantially increased, to develop a highly skilled and equally strong and efficient workforce – particularly in the poorer states; and simultaneously up-skilling to meet increased technological advancements/ developments in the world arena
- India's economy should be able to respond to the demands and not be an obstacle to growth, during this transition
- Creation of an adequate number of opportunities for skilled youth in

Infrastructure – housing, schools and colleges, roads, medical facilities, ICT, etc. would in turn terms require a large financial input!

Higher Educational Institutions and Quality

Education, in general, all over India, is on the concurrent list, which implies that the various States of the Indian Union and the Central Government share responsibilities. Higher education was to be a not-for-profit sector. The University Grants Commission is the controlling/governing authority for all the universities (Institutions of higher education) established in the various States of the Indian Union, under Section 3, of the UGC Act of 1956. However, by an Act of Parliament, Central Universities, and through State Legislation, State Universities came into existence.

All of the above universities were authorized to award their degrees. These institutions, could formulate their curriculum and syllabi, conduct examinations, appoint their faculties, and also collect fees from students. They are however to concur with the guidelines of the UGC and other statutory bodies, which could stand amended from time to time. Most of the HEIs in India have their teaching-learning processes oriented towards Outcome Based Education (OBE)!

Change-over demands a shift in Blended T-L pedagogy:

- Teacher-centred to Learner-centric.
- Peer/Collaborative Learning.
- Case-based Teaching Material.
- Focus on Why and How - Scientific Thinking, Reasoning; Critical Thinking.

HEIs in India have started offering online degree programs, and the teaching-learning processes are being improved considerably. Blended hybrid learning, incorporating integrated learning modules/ digital elements has been introduced into the regular program curriculum. There seems to be considerable interest in the working classes attending these programs online; this may help to a certain extent the amount of up-skilling that may be needed.

These HEIs are free to get accredited through National Accrediting bodies like the National Assessment and Accreditation Council (NAAC) for Institutions and the National Board of Accreditation (NBA) for technical programs. However, the Central government envisages the merger of these two bodies into the Higher Education Commission, Government of India under the National Education Policy-2020. Additionally, international accreditations like the ABET, JCI, AACSB, and the like, may also be considered to make HEIs more acceptable globally.

Therefore, what is needed to meet future global challenges is our HEIs must develop indigenous content and upgrade their research.

To Derive Advantages of the Demographic Dividend

We need to develop fast-thinking, sophisticated intellectuals to drive the economy. Increasing higher education graduates of class, who could work globally and locally; be globally competent and relevant! Accordingly, the HEIs should offer globally competitive and innovative programs, which could serve the domestic and global markets! Collaborate with the best of institutions abroad, if need be, thereby raising our standards - our graduates and intellectuals capable of working and serving economies abroad, as well.

Information that needs to be tackled is that the expansion in the working-age population may be concentrated in the rural areas/villages; educating and up-skilling this group may pose a difficult situation for India. It is felt that in the later years of the last decade, the labor force population was only 49.8% of the working age group. Further growth could only be unemployment of the working force! These results lead to a big concern that the growth in the future could turn out to be jobless because of de-globalization, de-industrialization, the fourth industrial revolution, and technological progress.

HEIs should do away with their outdated curriculum, higher student-teacher ratios, outdated equipment, lack of quality faculty, and lack of institutional and industry collaborations.

HEIs should invest in higher spending for research through grants and commercial projects. Though there are a large number of start-ups, concentration should be on those which are of global relevance, continuing research, and the possibility of reaping patents, through incubation setups as well. Well-planned entrepreneurship programs should be regularly conducted. All the curricula should be developed to incorporate 'Sustainable Development Goals' in line with global practices, as enunciated by the United Nations Core Committee on Sustainability.

Most of the HEIs lack professional management, very pathetic governance standards, and a lack of will to change. They are interested in making huge profits, rather than harp on quality. They fail to understand sooner or later, that quality brings in huge returns, while those neglecting quality may disappear into oblivion.

Vocational Education to quote AICTE - "might be classified as teaching procedural knowledge. This may be contrasted with declarative knowledge, as used in education in a usually broader scientific field, which might concentrate on theory and abstract conceptual knowledge, characteristic of tertiary education." With businesses moving more towards higher levels of technology with heavy demands on higher levels of skill, there is going to be a heavy demand for highly strung vocationally trained artisans! Vocationally trained higher level of skilled people would be in great demand in the coming decades.

Conclusions

As is evident from various conferences and meetings being held, all the countries are working hard to meet the changing world scenario to find proper employment and infrastructural necessities for their people. India should be in a commanding position in this regard, provided it can deliver quality education and sufficient infrastructure to meet the demands of its population – more schools, hospitals, housing, roads and communication facilities, and finally power and water!

Developing countries and India in particular, would have to face investments of a large amount to upgrade their existing infrastructures to required standards if they were to step up their GERs and also the quality of education being offered in their countries. This is not going to be an easy affair, particularly taking into consideration the backwardness of ICT and other rural facilities. They need to keep pace with further developments taking place in the advanced countries, in terms of gadgets and ICT systems and faster development of technologies! Having reviewed some of the problems globally, every country has to decide and establish its practices to suit its requirements and its Diasporas!

"*A distinguished panel of the globe's top economic minds concluded that every country that sustained high growth for long periods put substantial effort into educating its citizens and deepening its human capital.*"

- Wharton Report

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Themes/Subthemes for the Special Issues of University News-2023-24

S. No.	Zonal Vice Chancellors' Meets-2023-24	Theme/ Subthemes for Special Issues	Last Date to Contribute*	Date of Publication
3.	**Central Zone**	**Nurturing Research and Innovation Ecosystem** *Subthemes* • Collaborative Research Networks: Fostering Inter-disciplinary Research • Entrepreneurship and Innovation: From Idea to Impact • Innovative Funding Models for Research	January 08, 2024	January 15-21, 2024
4.	**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

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Innovation in Higher Education: Management, Needs and Challenges

Anuradha Sharma* and Parineeta Jindal**

Higher education has been on a transformational journey according to the needs of the stakeholders. Higher educational institutes are places where students are not only awarded certificates for their degree courses but are also prepared to face life's challenges with courage and strength of conviction (Chauhan, 2023, p.14). Graduating as per level of education is one of the important ways to nurture the potential within an individual. It is an instrument to revolutionise the thought process and change society at local, district, national, and international levels. Education and its implementation enables people "to reach their full potential, creates a just and equal society, and promotes total national growth" (Sharma and Parul, 2023, p.19).

During colonial times, universities were established to produce graduates who would serve the interests of colonial rule (Tripathi, 2023, p.7). However, with the advent of the National Education Policy (NEP)-2020, the purpose of education has changed. Now, Bharat is trying to break free from the bondage of slave mentality and thinking beyond. For example, NEP-2020 has been framed to foster creativity, and encourage thinking critically, research, and innovation among the students thereby transforming Bharat into a knowledge and self-sufficient society. A few areas highlighted in NEP-2020 include setting up start-up incubation centres, hand-holding mechanisms for nurturing creative and innovative ideas of students, creating a culture of innovation, promotion of creativity among students and faculty, innovations in curriculum, teaching and pedagogy, innovation in technology-enabled learning and assessment, etc. (Rao and Sharma, 2023, p.3).

Innovation is introduced so that students learn better, are instructed better and educational functions are better organised, regulated, governed, and financed (Wilson & Sy, 2021). For example, an innovation ecosystem can be created in the university to promote, support, and nurture innovation and innovative practices by the students and teachers (Rao and Sharma, 2023, p.3). During the COVID-19 pandemic, virtual reality and flipped classrooms were one of the few methods that got popularised for teaching and learning. As almost everything is available on the internet, so flipped classroom is a better option as it gives experiential training and hands-on experience. A flipped classroom means that the instructor pre-records the lectures, posts the recordings to Canvas for students to watch before class, and then assists the students as they work through assignments during class time (The Derek Bok Center for Teaching and Learning, n.d.). The students with average levels of intelligence could revise their lectures at their pace as many times as they want which could also be one of the reasons for better performance in students.

A change, whether imposed or voluntary, usually faces some anxiety and resistance among the stakeholders before it is accepted or accustomed to the benefit of beneficiaries. Proper management of resources like material, financial, and human makes it possible to bring innovation in education and reach out to the beneficiaries.

Management

The goal of management is to improve the education system. Management functions involve planning, organizing, staffing, leading, and controlling to ensure the best possible educational outcomes by integrating various resources (Shreshtha, 2009). These are as follows:

Planning

Different aspects of higher education institutions are to be planned such as capital investment in the buildings, renovations, classroom technology, utilization of classroom space, maximization of a program being offered, and so on should be given importance for the faculty and students to maximum the input and output process.

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Organizing

Each person should have defined responsibilities and duties. It helps to organize the human infrastructure and carry out the functions for the implementation of policies and programs for higher education.

Staffing

Education should be learner-centric. Hence, trained faculty must be available to teach the subjects to the students. Teachers should attend various training courses from time to time to enhance and upgrade their teaching skills and knowledge. Faculty should have subject expertise, participate in programs like CSR, and be able to think innovatively and implement the ideas as required. Faculty development programs and staff improvement programmes should be regularly organised to acquaint them with new technology and dynamics occurring in the teaching-learning process. Institutions should recognize the staff and teachers for their unique innovative achievements.

Leading

It is important to direct and motivate others and resolve conflicts so that the objectives of higher education can be achieved. Thus, stakeholders play an important part in the process. Stakeholders add value and meaning to the organization in innovative ways in the areas of curriculum development, placement of students, experiential learning, etc. Thus, sharing the vision and inviting ideas from stakeholders helps to build commitment to managing innovation and reduce resistance. There are two types of stakeholders internal and external. Internal stakeholders are students, research scholars, faculty, employees, senate, and employers. External stakeholders are parents, alumni, shopkeepers, and collaborations with other organizations (*https://kiit.ac.in/policies/stakeholder-engagement-policy/,* 2022; Indeed editorial team, 2023). The following are the roles of stakeholders:

Student Council

The student council debates the issues of concern with the governing body i.e., vice-chancellor/office-bearers/professors, and undertakes projects of benefit to the institution. The student council is responsible for promoting a conducive environment for the personal and professional development of students and the governing body. Student council is a bridge between students and the governing body for the expansion of education.

Academician

Academicians should have a critical dialogue with students about course design, teaching methods, and assessment methods. It will enable to improvement of teaching pedagogy and inculcate a positive teaching-learning environment for each student.

Parents

Parents provide emotional support, financial support and guidance, academic mentoring, and career support. Parents can play an important part in addressing any concerns or challenges their wards may face during their attainment of higher education to the administrators and academicians of HEIs (MIET Bhubaneswar, n.d.).

Alumni

Alumni can participate in policy-level governing bodies of HEIs and can also be a part of various academic and non-academic advisory bodies and share their professional experiences which is beneficial for the higher education system. Alumni can mentor students, and sometimes leverage their contacts to support university administration, faculty and students in their various endeavours(*https://www.ugc.gov.in/pdfnews/0128028_Alumni-and-Career-progress-Policy_doc.pdf*).

Researcher Scholars

Research scholars can present their insights based on their research which can be implemented in the institution for the benefit of students and faculty. Research scholars should conduct more and more investigations and inventions, and think new ideas in the field of technology and social science field which should be implemented as per requirement.

Administrators

The administration materializes the tasks according to the constituted policies and programmes. These professionals motivate faculty to excel, develop guidelines for action, determine the accountability of the staff members, solve legal disputes, allocate funds for the salaries of faculty, or seek grants for a research project from the government.

Controlling

It is important that continuous monitoring is carried out so that any gaps, conflicts, or discrepancies between the planned and achieved goals can be resolved. For this purpose, a positive learning environment should be created. Systematic and periodic assessment methods should be devised so that the results act as constructive feedback for the student and teacher. Successes should be celebrated along the way helps to keep the stakeholders, students, and faculty motivated and engaged in the change process and mistakes should not be made fun of. Time-to-time appraisal reports of the institution, faculty and staff should be maintained. Action taken report should be developed to manage the qualitative improvement of HEIs.

Needs of Students and Professionals

To prepare students for the challenges of the 21^{st} century, the following are the needs of the students and professionals:

Teaching Pedagogy

Students learn by asking questions, collecting data, and analyzing information. Students should be encouraged to ask questions and seek answers. There should be the use of discussion methods and more engagement of students. Various ways of teaching-learning methods should be accepted like discussion, debate, research, and opportunities for cross-disciplinary and interdisciplinary thinking. Idea competitions can be organised to encourage students towards creative and critical thinking and idea generation (Rao and Sharma, 2023, p.6). Online, offline, and blended modes of teaching should be encouraged for maximum learning. Faculty should have the freedom to design their pedagogical approaches within the approved framework which includes textbooks, reading material selections, assignments, and assessments.

Maintenance of the Dignity of Students

Youth welfare programs should be conducted to create awareness regarding respect for the dignity of life. Everyone should be taught human values like truth, righteous conduct, peace, love, and nonviolence. Each one has the right to live life with dignity.

Capacity/Potentiality of Students and Promotion of Cultural Values

An educational institution i.e., school/college/university/institute is a place where a learner should be groomed to reach their full potential whatever his/her level of intelligence.

Value-based education should be provided which includes the promotion of human values, life-skills, lessons in seva/service and participation in community service programmes. Indian culture should be promoted more such as wearing Indian costumes once a week for girls and boys without any competition or bias. However, it should not be assessed or graded for promotion to the next level of education.

Counselling Programmes Organised

Students facing stress and depression due to various reasons should not be demeaned or looked down upon. HEIs should arrange seminars, workshops and lectures to generate awareness of mental and emotional health and positive solutions to deal with it. Mentorship programmes should be encouraged with a proper mentor-mentee ratio in which students can share their problems and be timely guided as per the capacity and capability of the mentor.

Health Fitness

Health should be given priority to students, faculty and employees. They should be encouraged to participate in physical activity such as yoga, gym, sports, and dance or recreational activity like music, arts and craft, etc as per his/her liking. Meditation sessions should be organised by HEIs from time to time every year for employees, professionals and students of HEIs.

Students should be given awareness about proper eating habits and a balanced diet. Besides, a nutritious diet should also be given in hostels as food is the main source of energy. A saying goes ‘As the food, so the mind’.

Spirituality can be useful in enhancing the productivity of the person. Lectures related to life-skills, spirituality, and great personalities like Swami Vivekananda, Swami Dayananda, etc should be given as it acts as a torchbearers for life (Malla, 2023, p.33).

Skill Enhancement and Value-added Courses

Skill enhancement, value-added courses and community engagement will build confidence in students to deal with problems of life. These courses should be a part of co-curricular activities. These courses could include lectures on effective communication, basic computing and data analysis, environment, *swachch bharat* mission, etc. Skill enhancement programs like communication skills should be organised. Communication enhances people's capacity to work stress-free, making the environment energetic, and adding a positive vibrancy. Moreover, positive communication helps to build a positive personality (Sahu, 2023, p.32). Hence, lectures on how to be effective in communication should be included in the value-added courses.

Flexibility

Students can study subjects of his/her own choice. Curricular structures should be flexible to enable creative combinations of disciplines for study and would offer multiple entry and exit points, thereby, creating new possibilities for life-long learning.

Workshops, Seminars, Online Courses, and Conferences

Both students and faculty should be encouraged to participate in workshops, seminars, online courses and conferences. These help to keep abreast of the latest knowledge and generate new ideas. Innovation involves that teachers need to be prepared to teach both in classes and in front of a camera (Mittal, 2023, p.25). Research forums should be provided to enable collaboration and networking among researchers. It encourages exchanging ideas, gaining publicity, and establishing crucial relationships within the academic community. Besides, it increases confidence and enhances the quality of their studies (Saha, 2023, p.29).

Technology

Students in more than 90% of higher educational institutions desire a mobile phone and/or an internet connection. Mobiles and data connectivity are used as a staple for information processing, communication and sharing of knowledge. Artificial Intelligence may create "virtual mentors for learners", assist learners in getting 21st-century workplace skills (such as teamwork and self-direction); bring about vast amounts of data for individual learners, increase inter-connectedness among classrooms far and wide across the globe; and give learners outside the classroom virtually (Patil, 2021, p.111). But it is also to be ensured that students should be safeguarded against information inappropriate for them which may lead to violent thoughts and destructive behaviour (Pithadia and Thavani, 2023, p.15).

Research-based Learning

Research-based learning can also make learning more fun and experiential (Patil, 2021, p.111). When students are actively engaged in the learning process, they are more likely to be motivated and retain the information they learn.

Collaboration

Educators may collaborate with students and colleagues to promote research (Das, 2023, p.29). According to Krishnan (p.26), "Collaboration and partnerships between educational institutions, governments, and content creators will be crucial in fostering the growth of Open Educational Resources (OER) and realizing its potential to democratize education worldwide." It will provide students with the needed best infrastructure and resources, therefore, universities must team up with other universities and super speciality educational institutions (Sharma and Parul, 2023, p.23).

Support Diversity

By discovering and innovating various methods in education and managing them effectively, learning will reach every corner of the world (Patil, 2021, p.111). Creating an environment that is supportive of diversity and inclusion is important for creating a culture of innovation in education (Drexel University School of Education, n.d.). It benefits students, faculty, and society as a whole.

Prioritize Needs

Top priority should be given to developing methods to create an innovation ecosystem in the HEIs which should align with the national priorities, Sustainable Development Goals (SDGs) and international demand (Rao and Sharma, 2023, p.4).

Focus on the Process

Three aspects are important in curriculum development: context, content, and delivery mechanisms. The curriculums must provide for experimentation, self-upgradation and innovation, and assessment-based corrections from time to time. Directions for teaching, procurement of human material, redesigning classrooms, and assessment processes should also be laid down in the curriculums to enable the implementation of the envisioned programs (Saidapur, 2023, p.18).

Create a Culture of Innovation

Innovation is a continuous process of improvement. Innovation club to create a culture of innovation among faculty members, staff, and students may be set up; various competitions, and documenting and disseminating innovative practices with other institutes should also be encouraged to promote a culture of innovation (Rao and Sharma, 2023, pp.4,13). Professionals need to be innovative in their teaching methods, learning environments, availability of subjects and assessments. One of the most important roles of management in education is to create a culture of innovation. This means encouraging teachers and administrators to experiment with new ideas and to take risks. It also means providing them with the resources they need to implement these innovations.

Focus of Future Education

The focus of future education needs to be on curricular content, context, and community. It also needs to focus on learning to know, learning to do, learning to live together, learning to be in a social society, learning to dare, dare to know, and learning to undertake (Saidapur, 2023, p.14).

Measure the Impact of Innovation

The education system must include a continuing feedback mechanism and the use of data to measure the impact of innovation so that the HEIs can see what is working and what is not (Sharma and Parul, 2023, p.23).

Challenges in Higher Education

Choice-based Subjects

It involves providing a choice of more subject combinations (conventional and unconventional). A student upon his/her admission to college can only choose from the subjects for studies that are available in that college be it of his/her interest or not because of the availability of the seats for that particular subject whereas a student should be free to choose subjects of his/her choice/interest irrespective of availability of seats or some limitations. Sometimes faculty of desired subjects is not available or students don't prefer other colleges.

Creation of New Faculty Positions

Well-qualified professionals should be recruited as per the demand of subjects instead of depriving the student of studying his/her favourite subject. Professionals should be given a pay scale with usual allowances so that they feel self-fulfilled, encouraged, and motivated. They should have good knowledge of technology.

Infrastructure and Resources

In today's era, innovation also requires being well-equipped with technology for which a good infrastructure and resources are required. It includes internet connectivity in remote areas, smart classrooms, and technology-savvy teachers with good techno-pedagogical skills which are expensive (Sharma and Parul, 2023, p.21).

Redesigning of Curriculum

The curriculum has to be redesigned not just in its content but also in multiple languages for which more resources are needed which can be availed with proper funding and infrastructure (Sharma and Parul, 2023, p.22).

Encourage a Harmonious Environment to Promote the Quality of Education

Formation of different segmentations sometimes leads to unrest and imbalance in the working of HEIs, thereby, leading to intellectual dissatisfaction which affects the quality of education. Each employed professional or budding professional should be valued for his/her pedagogical skills and talent. Hence, a harmonious and encouraging environment, and facilitation in the process instead of objections should be provided in HEIs for all professionals and students.

Freedom from Duties Other Than Teaching-learning Activities

Faculty members are often involved in duties such as preparing excel sheets of grades, attendance, and credits students have attained. So, they don't get time to invest in the teaching-learning process and research work.

Teaching-learning Facilities

There should be smart classrooms and projectors for an impactful teaching-learning process. There should be a microphone in hand for effective delivery of the lecture in the class so that voice reaches every student in the class hall, and adequate time, funds, and facilities to pursue research should be there else it affects the quality of higher education (Raghavan, 2023, p.7). Besides, there should be some freedom to foster creativity and growth.

Conclusion

With changing times and experience, the education system needs to be reconfigured so that the needs and challenges of students, faculty, and parents can be met. Education should make the students self-sufficient. Keeping in view the condition of rural and urban areas of the country, the facilities should be made reachable to the HEIs so that the standard of quality of education is upgraded. Management functions lay down the basic framework to manage innovation in the higher education system. The education system must welcome experimentation, respect the dignity of everyone's life and attention to holistic health. With the cooperation and understanding of stakeholders, students and faculty, a seemingly convoluted task of innovation in higher education can be effectively managed and benefit many. Thus, reconfiguring of education system is a journey, not an endpoint.

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Education 4.0: A Conceptual Framework for the Use and Integration of Immersive Technologies in Higher Education

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There are now 40,000 HEIs in India as a result of education reforms, which indicates significant fragmentation. There are around 845 universities in the country (Kumar, 2005) as well as other smaller HEIs connected to these institutions. There is no denying that educational institutions' capacity to properly impart knowledge and technological flair in a traditional educational context has been surpassed by the drive to use technologies in higher education. The National Education Policy (NEP)- 2020 from the Ministry of HRD is innovative in every way. The strategy focuses primarily on the interplay between education and technology, even if it also tackles concerns like early childhood programs, diversity in curriculum, and instruction. In the twenty-first century, the need for ICT in education grew quickly. Alam (2021) recognizes the value of technology in advancing transdisciplinary research and innovation as well as in enhancing instruction, acquiring knowledge, evaluation, organizing, and management in the area of education. Although technology-enhanced education is often used at a basic level, high-level application seems to be less common (Ertmer, Ottenbreit-Leftwich, and York, 2007). This policy includes developing guidelines for contents, ICT and technology-based teaching-learning pedagogy, designing and implementing online assessment techniques, and instructors to become world-class content providers for both online and offline pedagogy. The strategy calls for the creation of a special division to manage the acceptance of technology resources, capability, and infrastructure for institutions of higher education According to Smith (2009), as advances in modern technology continue to change the world, so education sector is also required to reflect these breakthroughs.

According to criteria created by educator accrediting authorities and professional organizations, technology skills that are critical are anticipated in all educational contexts (Javeri and Persichitte, 2007). Even though the incorporation of technology into courses for higher education might be the actual purpose, research on a small scale is carried out to achieve this (Keengwe, 2007 and Porter, et.al., 2014). Improving the teaching-learning process is crucial for academic achievement. Since the turn of the century, education has faced several problems, and ICT has had a significant influence on higher education (Webber, 2010). This present generation of youth processes information differently, and learners' capacity to think creatively does not improve and is heavily reliant on techniques of transmitting information, such as visualizing images. As a result, today's printed textbook is less appealing to learners than in past years. Even video footage is not sufficient for explaining a complex concept, idea, or procedure. All of this has a detrimental influence on educational quality in general, especially with low levels of student enthusiasm. In this instance, there is a need for new tools to be proposed to establish extra experiential learning opportunities on the institution side and improve student motivation. Immersive learning is one such tool for improving the learning process, which involves artificial intelligence and virtual reality, 3D movies in the educational context.

Blended learning combines face-to-face lecturing with technology to improve student learning. Anytime, anyplace learning leads to lifelong learning. Government and HEIs acknowledge hybrid education's growing relevance in today's environment. Alam (2021) emphasizes using immersive technology to improve student learning, teaching, assessment, strategizing, and management (Ertmer, 2005). This paper proposes a conceptual framework for using immersive technology in higher education. The study goals are:

- to understand the transition of higher education in India and the components of Education 4.0;
- to learn about immersive technologies, their application, and implementation in higher education; and

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- to create a conceptual framework that relies on both external and internal aspects in the HEI environment that impact the use of immersive technologies to achieve effectiveness.

Secondary data from scholarly journal articles, online blogs, white papers and books were used in the study. Search engines and phrases such as immersive technology, VR technology, technology utilization, new normal in higher education, NEP- 2020, and others were used to discover the information. The received material was assessed and incorporated into the model development process.

Literature Review

The Paradigm Shift in Higher Education in India

New paradigms are produced through thought revolutions that disrupt established traditions in a professional group. Both at the primary and senior levels, education has undergone a significant transformation since World War II. In the past 50 years, all levels of global education systems have experienced significant growth. Several countries had hope for the future owing to the 'knowledge - based economy' (Shore and Wright, 2017). To fulfill the demands of commercial markets and governments, Higher Education Institutions (HEIs) have undergone continuous reforms that have improved their effectiveness, efficiency, and success. Bhaja and Hammad (2018) assert that the recent rapid rise of ICT has had a significant influence on the education system. Generally, online education has grown at an exponential rate, which has had a significant influence on teaching methods and classroom practices throughout COVID-19. The prevalence of online education has steadily increased due to several factors. To begin with, the use of smartphones and internet services has increased significantly in recent years, which makes remote learning simpler. According to National Education Policy (NEP)- 2020, multidisciplinary Higher Education Institutions (HEIs) are to become more prevalent in India, more colleges and universities are to be established, faculty and institutional individuality is to be promoted, and course content, pedagogical practices, assessment, and student services mechanisms are to be redesigned at both the both undergraduate and postgraduate levels (Bhat, 2020). Higher education places a strong emphasis on subjects like environmental education, biological existence, design thinking, intelligent systems, global curricula, and other relevant subjects.

The digital divide is one of the primary difficulties impacting online education. According to MIT, the excerpt from The Vantage magazine, leading universities have been devoting funds to spend on academic staff to explore the newest instructional innovations and to prepare for and undergo training to become conversant with these methods and technology capabilities. The University of Southern New Hampshire uses IT and audio-visual capabilities to create a collaborative environment fit for the twenty-first century. The incorporation of cutting-edge technologies like various blockchains, augmented reality, virtual reality technology, AI, NLP, and machine learning, portrays what will be the higher education's future. While many higher education institutions use the AI tool 'bartleby write', which checks for grammar and plagiarism and has developed into an assessment tool for grading students' assigned tasks, they are also investigating an assessment method that incorporates AI techniques (Marcus, 2021).

Technology and Education 4.0

The term 'Education 4.0' has received a lot of attention in recent years from many numbers of authors who have imagined it by well-known industrial revolutions period from 1.0 to 4.0 in the past. As a result, it has been examined how the development of technology over time has affected the education sector. As a result, the conceptualizations take into account learning pedagogy, instructional philosophies, teaching methodologies, information resources, methodologies in learning, and roles of educators and students. The recently proposed notion is based on the modern objective of Education 4.0, which seeks to educate, a young generation of very competitive individuals adept at using the proper technologies to deliver innovative solutions to current and future difficulties in society. What is currently referred to as 'Education 4.0' includes the technology, cutting-edge educational approaches, and practice guidelines that characterize the fourth industrial revolution.

With the help of growing technology and sophisticated infrastructure, instructors, and learners have been able to enhance the pedagogical practices used in higher education. To meet the demands of a technology world that is always changing, educational techniques are also adapting and realigning their paradigms toward innovations in their instructional process. As a result, knowledge creation in Education 4.0 is thought to transcend pedagogical and andragogical approaches in favour of a strategy that blends. The recently proposed notion is based on the modern objective of Education 4.0, which seeks to educate, young generation of very competitive individuals adept at using the proper hardware and digital instruments to deliver solutions that are innovative to current and future difficulties in society heutagogy, pedagogy, and cybergogy. Therefore, Education 4.0 supports student-centered heutagogy-based self-learning that is founded on humanistic and postmodernism principles. Self-reflection and metacognition, or the learning process of an individual are supported. Peeragogy, which refers to the foundation of peer learning, is a conventional concept that has been offered new meaning with the initiation of Education 4.0. It refers to a set of teaching techniques that supports peer learning. (Ouhriret, al., 2019). Cybergogy has also developed as a result of technology advancements and the development of the internet, which have benefited educational initiatives. Cybergogy is a term used by Daud, et al. (2019) to describe learning methodologies supported by ICTs that provide learning experiences that transcend time and location. The current era of education, known as 'Education 4.0', is one in which institutions of higher learning use new instructional and managerial techniques, smart and sustainable infrastructure, and newly emerging ICTs to enhance the processes of knowledge creation and transfer of information. Combining these technologies can aid in the acquisition and development of critical and most important competencies in today's learners.

Technology Integration

Technology integration is defined as integrating technology into education is essential to improve student learning and academic achievement (Okojie, 2006). Therefore, Technology integration is used in a classroom learning environment to aid and assist in instructing, enhance student learning, and promote better education quality. As a tripartite paradigm, technology, learning, and instruction enable students' academic brilliance and foster instructors' critical thinking skills by the curriculum's guarantee of learning and course outcomes (Diaz and Bontenbal, 2000)

Technology Use

The four aspects combine to develop an individual's desire to use a technology or system that is computer-based and the goals and intentions are a good indicator of whether that individual will do so, according to Davis F. D.'s (1986) Theory of Reasoned Action (TRA). Royer (2002) found that faculty members were more willing to employ classroom educational technology the more they contributed to its practical setup. Therefore, educators must receive technological training. The more experience an educator has with immersive technology, the more likely they are to incorporate it into their education, claims Hsu (2010). To be an excellent practitioner of technology for education, educators must have faith in people's ability to use it and a commitment to doing so, according to a poll on faculty opinions of the values (Ertmer, et. al., 2007). There is a need for faculty members to have the skill to integrate technology into their classes as well as know how to use it in general (Baylor and Ritchie, 2002). The main factor that might affect attitude towards the use of technology in learning pedagogy is faculty development (Reynolds and Morgan, 2001).

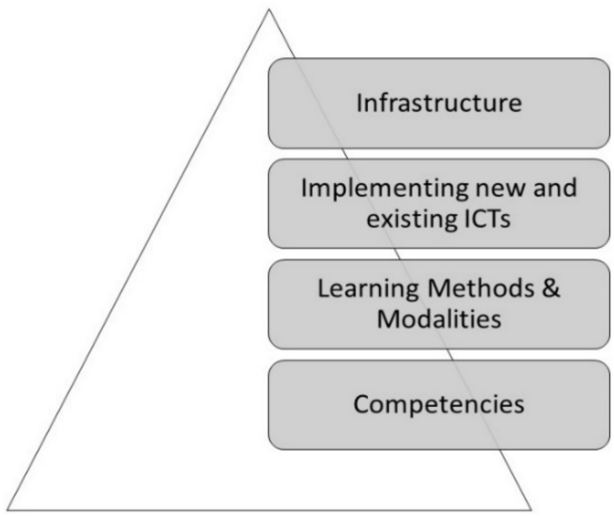
Components of Education 4.0

The suggested idea of Education 4.0 is made up of certain fundamental elements. Competencies, Learning Methods & Modalities, ICTs, are among these components as depicted in Figure 1 below.

Competencies

Competency-based education has transformed higher education since the 1990s. The growth of professional capabilities at universities, both transverse and disciplinary ones, faced issues in establishing instructional models to equip learners with knowledge and skills. (Brunel and Viesca,

Figure 1: Education 4.0 -Components



2014). The key skills of higher education have been described by certain organizations and academic institutions (Germaine, et. al., 2014). These skills have sparked the development of innovative teaching methods, exercises, and technology. Because they include emotional, psychological, relational, and intellectual skills as well as the corresponding behavior and knowledge, the above-mentioned competencies described in this study are crucial.

Learning Methods and Modalities

Conventional teaching methods will need to incorporate activities, technologies, and approaches that let students enroll in educational and other training activities under Education 4.0. To offer more effective, accessible, adaptive educational solutions, Education 4.0 has developed new teaching and learning methodologies that combine technology with tried-and-true pedagogical principles. To improve knowledge development, information transfer, and resources, new teaching-learning methodologies are presented in a variety of media. Programs for in-person, online, and mixed learning have developed. Lifelong learning and adjunct certification programs have bloomed as a result of the expansion of online education programs using IoT connections. The learning process is actively engaged by students, and new programs adopt learner-centered models that make use of emerging and present technologies to improve teaching-learning. Innovative learning approaches include the use of pedagogical strategies including challenge-based education, problem-based scenarios, experiential methods, gamification.

Implementing New and Existing ICTs

There are two methods to approach the ICT element of education 4.0: In Technology-based ICT, utilizing the underlying concepts of technologies, methods to offer solutions that are technology-based. Current and upcoming technologies boost the education sector's platforms and applications. Many technological implementations that assist pedagogical processes include IoT-powered approaches such as AI and ML, massive processing of data using Data Science, Analytics, Cloud Computations (Q.L. Cheng, 2019), virtualized and experiential settings using virtual image processors (Salinas-Navarro, 2019). This development has enhanced existing platforms and tools and led to creative applications. New technology-based tools and platforms that combine different technologies for administrative and educational goals. The aforementioned methods and guiding principles have led to the development of powerful tools, and sophisticated platforms that have enhanced teaching and learning procedures in numerous ways, such as web-based platforms that process vast amounts of data and offer services like e-mail, blogging, forums, virtual classroom (Venkatesh, 2014). Thanks to ICTs' capabilities, traditional teaching and learning may be improved and innovated. Complementing or replacing traditional education modalities are virtual classrooms and collaboration tools (Terry, et. al, 2019). Mixed reality laboratories (Knox, 2019), robotics in education (Salas, 2019), internet-based learning, machine learning, intelligent tutoring systems (Boguski, 2019), robotic assistants for teaching, simulated and experiential contexts (Salinas-Navarro, 2019), and holographic formats of teachers (Paredes and Vázquez, 2019) are some tools and platforms used.

Infrastructure

The learning environment in Education 4.0 is aided by infrastructure that suits students' demands for learning and contemporary instructional and management issues. As a result, novel physical and virtual infrastructures are emerging. Classroom and institutional levels are proposed to define higher education's present architecture. The classroom level analyses innovative furniture, networked devices, and other instructional and pedagogic resources. These rooms can contain augmented, virtual reality and holographic technologies for interacting with digital resources. Recreation, teamwork, and comfort are also considered. Institution Level considers educational facilities, resources, and systems. This infrastructure supports instructional, administrative, and support processes. Today's universities provide improved educational experiences and industry standards for learners, faculty, and employees. ICT solutions that enable blended learning with internet conferencing and LMS use connection and digitalization with virtuality. Online libraries, instantaneous chat, and virtual labs are extensively used.

Immersive Technologies in Higher Education

Current developments include Cloud-based Relationship Management (CRM) of student services, assessment management systems, Learning Management Systems (LMS), and such technologies that will help institutions handle diverse tasks successfully. Video-based teaching and learning, assessments and detecting plagiarism, incorporation and accessibility of open access resources, machine intelligence for exam proctoring and reviewing assignments, virtual reality for experiential education, gamification, and virtual agents, digital assistants to help solve learning enquires independently and autonomously. Smart teaching aids, imagers, AV aids, etc., help educators facilitate learning.

Immersive technologies have been growing in popularity as of late, and they hold tremendous promise in the field of higher education over the next decade. According to Johnson, et. al. (2006) when we talk about 'virtual reality' or 'augmented reality', we are referring to technologies that either try to trick the mind into thinking it's in a place that's not there by using digital or simulated environments, or that attempt to augment the real world with computer-generated imagery. To create a feeling of immersion, immersive technologies aim to substitute organic sensory input with that provided by a computer (Slater, et al., 2016). Learners are immersed in content through the use of online technology, simulators, and other interactive content. Simulations, role-playing, as well as other activities that allow learners to put what they've learned into practice, can be utilized in both traditional and virtual classrooms to provide students with an immersive learning experience. Footage of ancient Greek tragedies and online photo galleries of ancient Greek locations are two examples of supplemental media that might be used in a history lesson on Ancient Greece. Furthermore, they may have the opportunity to interact with peers from all around the world. Immersive teaching methods can also be used in conventional classrooms. The ecology unit might include a trip to the local wildlife preserve led by the teacher. A mural depicting the life of Vincent Gogh can be the result of a collaborative project assigned by a teacher. Immersive technologies transform the content and typology of instructional materials: printed; printing with multimedia; electronic; electronic multimedia content, control, and external links; printed with augmented reality items; and virtual and hybrid publications. New AR technology integrated into old settings positively impacts learners. For example, AR books that are visually enhanced, conventional AR books that contain 2D static and dynamic text, 3D dynamic and static models, audio based on user activities and geolocation, etc. Immersive technologies are not limited to technical items. It's crucial to show their significance in medical education and the humanities and the arts. The following is a list of examples of the various forms of immersive learning, which is given in Figure 2.

Virtual Reality (VR)

An experience that is completely immersive and relies on head-mounted projections, often known as HMDs. These displays let users view a virtual space that completely replaces the physical universe. Within this parallel universe, communication and freedom of movement are of the utmost significance.

Augmented Reality (AR)

Augmented reality is the superimposition of virtual features in the real world that may be viewed via equipment such as a smartphone, tablets, or glasses which are see-through.

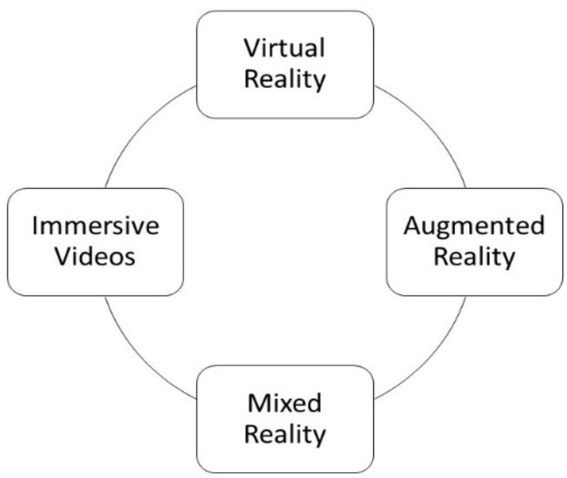
Mixed Reality (MR)

Devices may be categorized according to the function that they play in the physical and virtual worlds, and they can be positioned on a spectrum that runs from augmented reality to virtual reality. It is possible to insert new pictures in a real environment in such a manner that they can interact, at least to some degree, with what is actually in the physical realm that we are familiar with.

Immersive Videos

These spherical videos are based on video recordings in which a perspective is documented in all directions at one time using a pair of camera systems or an omni - directional camera. This gives the viewer the option to change the viewing direction during playback on a flat base display, just like they would

Figure 2: Immersive Technologies



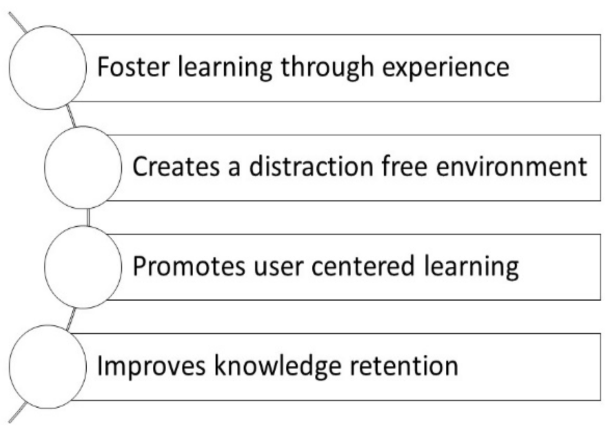
with a panorama. On the other hand, there is not much leeway for interacting with or moving around in the visuals.

Immersive technologies have the potential to increase educational opportunities in regards to engagement, drive, time involved, skills and knowledge, happiness of a learner, creativity, and inventiveness. Because the conventional restrictions of immersive technologies are becoming less significant as technology advances and costs fall, increased usage in education will be projected shortly (Fernández, 2017).

Advantages

As mentioned in Figure 3, students will learn through experience. It lets them use their skills to real-world problems and see their work's impact. Augmented and virtual reality help learners experience lifelike settings without actual engagement, such as hazardous or remote places. Without specialist tools, it's more economical and accessible for institutions. Immersive learning may transport learners to a quiet, distraction-free environment. Learners may get engaged in the virtual world and focus on the work with a headset, leading to enhanced information retention and learning. User-centered learning focuses on the learner. It guarantees each student achieves their learning aims and wants by recognizing their talents, and research found it boosts learner engagement and commitment. Immersive learning's adaptability and avatar-creation features allow learners to have a seamless and personalized experience. Knowledge retention defines a student's memory. It's vital for university students, exam takers, and potential employers. Previous studies demonstrated that immersive education improves spatial interaction and information retention among adult learners.

Figure 3: Advantages of Immersive Technology



Immersive Learning Strategies

We need more joy, reward, and motivation in the classroom setting. Gamification uses prizes, scores, and other game-like aspects to improve learning. Virtual learning games improve engagement, attention, and motivation. Simulations give learners real-world experience in the classroom. Immersing learners in a virtual setting boosts employability. A 2014 study indicated that virtual patient interviews can help nursing students develop empathy. You can use augmented, virtual, or mixed reality to create classroom simulations. Virtual reality may appear to be beyond reach, but companies provide discounts and financing for institutions. Mobile VR headsets connected to a student's smartphone save expenditures but improve the experience. Immersive technology, such as VR, has grown in popularity in a variety of disciplines in recent years, creating an attractive opportunity for 'academic institutions to investigate the advantages of VR for the teaching and learning process' (Srimadhaven, et. al, 2020). Virtual field trips have prospective educational benefits such as portraying field trips to inaccessible areas, displaying visuals from a variety of perspectives and measurements, boosting and broadening educational opportunities, offering a snippet, overview of actual field trips, aiding in recognizing systems that are complex with the addition of further explanation and information (Calişkan, 2011).

Conceptual Framework

A rising number of experts are debating if large investments in technology have a beneficial or detrimental impact on how students learn. (Oppenheimer, 2003). To achieve the aim and have a meaningful learning experience, instructors must develop courses that will inspire students to utilize technologies by themselves—this will make the process of integrating immersive technologies into the courses easier. (Wetzel, 2001)

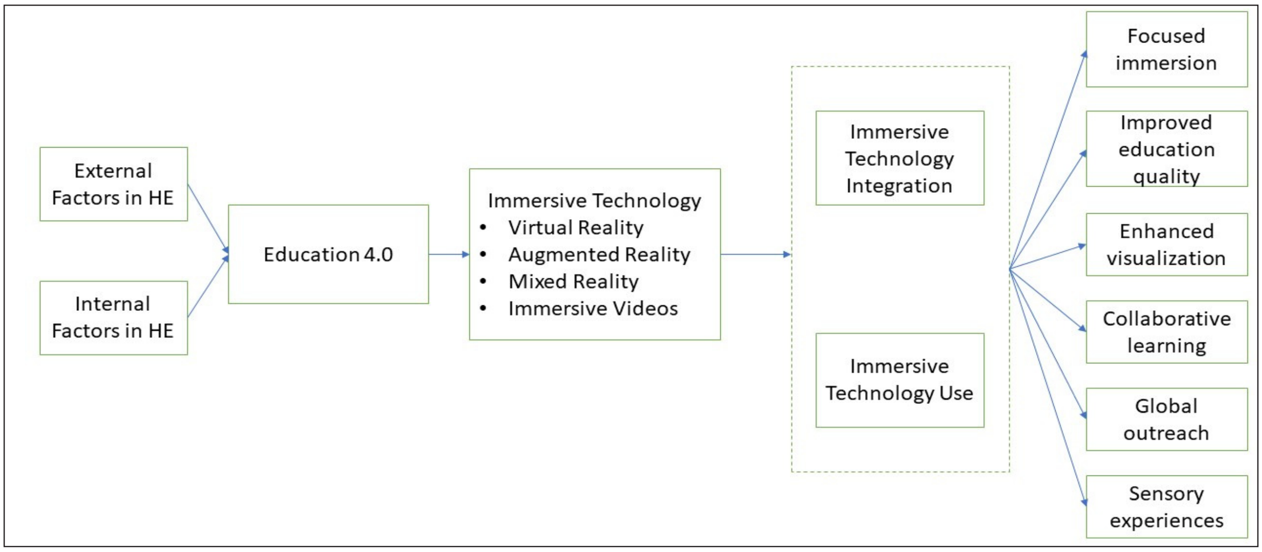
The current analysis has taken into account external factors such as government educational policies such as NEP- 2020 and the popular desire for high-quality higher education. The demands of this policy allow for faculty growth toward an education practice that produces excellent results. Internal factors mentioned in the study include budget allocation for technology implementation, which will provide access to all faculty and students, support from management and the organization, which will be an intrinsic and extrinsic motivator, faculty attitude toward technology adaptation, creating curriculum and developing pedagogy, openness to change, and an academic culture that will support faculty in terms of workload, moving away from traditional methods. As a student-centered educational policy, student attitudes toward accepting immersive technology use and integration into the curriculum are another important factor for immersive technology adaptation. Finally, curriculum, pedagogy, and assessment modifications must be considered before technological changes can be introduced into the educational framework because they will be infused in these areas.

This approach in Figure 4 focuses on factors and paradigm change in higher education creates a cataclysm to integrate and use immersive technology into academics. Immersive technologies can be virtual reality, augmented reality, mixed reality, and immersive videos.

Technology infrastructure's main function is to enable educational and student learning technologies. This entails utilizing technology to enhance connections between instructors and students. Accessible network capacity with decent speed and security networks are crucial issues for HE to solve because most institutions have web-based and database-based infrastructures (online enrolment, student financial aid, online listings, etc.). With technological integration, the pedagogy focuses on online learning platforms like Blackboard and Moodle. By creating a new online community that supports self-learning and enables students to encounter similar values, areas of expertise, and awareness, such as multi-user software, digital student assistance, and self-paced tuitions, education-support technology seeks to build networks (Olapiriyakul and Scher, 2006).

Additionally, it calls for private-sector outsourcing organizations, software engineers, cloud-based enterprises, data analytics experts, and other skilled workers. These individuals typically work for MNCs that have activities in both the private and public sectors. Additional data infrastructure efforts are introduced through public-private partnerships, think tanks, and educational consultancies. As with previous infrastructures, this indicates that 'new concentrations of international, inter-governmental, and quasi stakeholders' will collaborate on HE technology (Easterling, 2016). Funding has been directed at technology deployment; develop management devices to link classrooms to the web. But technology alone can't enhance education. Instructors must be trained to use the tools efficiently. Initially, in the IT boom, true faculty training was accorded scant respect. This may refer to technology adaptation. Instructors will acclimatize to the technology themselves. However, faculty talents go beyond a new perspective. Technology alone may not support tech-based pedagogies. A hybrid course involves three technology components (Dempsey,

Figure 4: Conceptual Framework



2002). Content conception, development, implementation, assessment, and modification are iterative. Here is where immersive technology is incorporated, so faculty training must be center of focus here using evaluate, design, create, execute, and assess (Gustafson and Branch, 2007). This leads to focused immersion, improved quality of education, enhanced visualization, collaborative learning, global extension and improved sensory experiences which will improve effectiveness in higher educations.

Discussion and Conclusion

Immersive technology will likely become increasingly common in education. Although costly, yet to be structured, and difficult to execute, potential benefits will spur quantitative investigations, technology progress, and cost reductions that will encourage this capacity in so many educational and instructional scenarios. Neumann and Kyriakakis (2002) from their research mention that these innovative immersion devices which are remote will give all students, regardless of location, immersive classroom experiences. High-resolution videos and sharing environments that are immersive 3D will bring educators and learners together, allowing natural debate, collaboration, and involvement. Instructors and students will study, explore, discover, and learn in a dynamic environment that adjusts to the contents, from a biology lab to an aquarium. Even Hinrichs (2003) and Javidi (1999) discuss how the position of the instructor will be impacted by the successful use of immersive technology in education. The instructor's position will change to one of a mentor and they won't be as active in the learner's direct instruction as they once were. The problem instructors will have in keeping track of a sizable number of learners if they are each participating in a distinct virtual learning environment. It is also mentioned that evaluation of learning could be challenging in virtual settings. This research on Education 4.0 and understanding its effectiveness will help higher education leaders integrate immersive technologies into education and make policy decisions.

Immersive technology as a teaching tool is still in development. Over the next ten years, there will undoubtedly be several technological and educational advancements that will support the expansion and use of immersive technology in several training and educational contexts. Nevertheless, other modifications and adaptations must take place before this technology can genuinely become an essential component of the typical educational setting. The technology has to develop further, be backed by additional scientific research, and become significantly cheaper for educational institutions. To properly take advantage of the immersive and engaging character of the technology, much consideration must be paid to instructional design methodologies and surroundings. Significantly, in a completely immersive, entirely virtual world, the function of teachers would shift. Immersive technology can probably be used as a supplemental technique to existing instructional methods, even though some expect such significant changes in the future. Although a significant change in the teacher's role would still be necessary for this more pragmatic perspective of the future of immersive technology in education, it would likely be more acceptable to educators than several more catastrophic scenarios visualised by certain authors in this particular subject. Education and immersive technology go hand in hand. We are about to enter a fascinating new stage in engaging with learners and motivating them to study. With the ability to experience new worlds, go to inaccessible locations, and give visual context to abstract ideas, VR, AR, and 360-degree video, MR can enhance learning by encouraging students' interest and engagement with the outside world.

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The Power of Humility

Rakesh Aggarwal, Director, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry delivered the Convocation Address at the 15th Convocation Ceremony of the Vinayaka Mission's Research Foundation (Deemed-to-be University), Salem, Tamil Nadu on July 07, 2022. He said, "I wish and hope that you will combine the practice of the knowledge that your teachers and institutions have equipped you with, with empathy and compassion -- to alleviate human suffering and to improve mankind, and not merely to earn money." Excerpts

Let me begin by congratulating the degree awardees and recipients of various prizes and medals. I can guarantee you that today will be a memorable and defining day in your life. This day marks the end of a long and tiresome period of education and training, culminating in your being certified as a specialist or an expert in your chosen field. You have completed a course of the most robust education and are receiving a highly valued degree. And particularly here in this convocation, we have only those who have completed their courses with a much higher level of performance than their peers. Only a small proportion of people reach this level of attainment. Hence, today, you should be, as you must be, full of a sense of pride and achievement. My heartiest congratulations on your accomplishment to all of you. Bask in the glory of the day, enjoy, celebrate- so that this day remains ever fresh in your memory.

I also congratulate family members of the recipients of degrees and awards - including their parents and, in some cases, their spouses and possibly even children. They have sacrificed a lot during the last few years, while you were busy studying and learning. They have possibly lived alone in a far-off town. They have run the household and looked after all the social responsibilities by themselves, possibly even looked after your child – all alone, without any help from you. Some of the family members, most likely mothers (and wives) would have woken up early to prepare the morning tea and breakfast for you. Why? So that you may pursue your dream and passion without any distraction, acquire knowledge and skills, and be in this hall today. You must all recognize their contribution, bow to them and promise to pay them back - by looking after them exactly as they have done for you over the past few years. And, to the family members - do share the joy of your wards today. Your hard work, your resolve, your '*tapasya*' has borne fruit- rejoice at it.

Let me also use this occasion to express my wholehearted appreciation for the faculty, staff, and leadership of this university and its affiliated colleges. They have imparted you not only knowledge but would have helped shape your thoughts, values, and careers ahead. They have done this selflessly, in the *'guru-shishya'* tradition of our country. From my personal experience, I can tell that you cannot (and will not) even realize the value of their contribution at this time. However, as the years pass by, you will find, as I have done, that your teachers have handed over to you a master key- one that will open several different types of doors throughout your life. Some of them will also silently dote on you through life - and will be available if and when you need them. They will be proud of you when you do well in life, and be upset if anything goes wrong with you. Do keep in touch with them, and it will be to your advantage.

We all think of convocation as marking the end of a phase of life. However, it marks the intersection of two different phases of life, the end of one and the beginning of another. A transition from being a student or trainee to a professional. From being 'cared for' to 'being responsible to care for others'. For those of you who decide to be teachers themselves, from a phase of receiving knowledge to a phase of imparting knowledge. From 'warm memories of the past' to 'dreams for the future'. From a 'cozy, familiar comfortable life' to a 'life full of new challenges, uncertainties and trepidation'. You will hereafter need to chart a new path for yourself, which would vary according to your field of study. For those from medicine and allied sciences, you will set up your professional practice - be it in an academic institution, with a non-governmental charitable organization, as your practice, or in a corporate hospital. Similarly, those in engineering and business management will also find a placement- in academia, in industry, or as entrepreneurs, such as by setting up a new start-up.

As you do this, you will find new co-workers, new friends, a new house, and a new city- and will need to adapt to these. The change may be difficult, but finally, you will surely succeed. I can assure you your teachers and your institution have prepared you for all these challenges. When in a fix, just think of one of your teachers and try to imagine how she or he would have handled the situation, and you will have the solution.

Let us look at what 'convocation' represents. In Hindi, my mother tongue, 'Convocation' translates to '*Deeksha Samaroh'*. I am sure it has a similar meaning in other Indian languages too. '*Deeksha*' has been an integral part of the Indian gurukul system, and is equivalent to 'initiation', 'consecration', or 'sacrament'. It relates to advice on how a fresh graduate should use the newly acquired knowledge. Hence, the concept of convocation is not merely one of celebration - instead, the day is imbued with a deeper and more solemn meaning. I, therefore, intend to spend the next few minutes sharing with you a few thoughts and some of what I have learned in my life.

My first advice is that you should 'Follow your heart'. Let me explain using an example of those from the medical field. You have several diverse paths available to you-joining a teaching institution, doing laboratory research, joining a corporate hospital or group practice and becoming a specialist healthcare consultant; working with a non-governmental organization at the grassroots level; joining an international agency engaged in public health; starting your solo practice; or even joining public service or politics. Similarly, the other professionals too have myriad possible career choices. You will need to decide which of these to follow. Similarly, you will need to make other choices in life: how many hours should I work, what kind of patients should I see, how much should I charge the patients, should I see some patients for free, etc. While making these choices, follow your heart. The path your heart suggests may appear to be difficult to follow, but things will eventually work out.

Each of you is like a seed- a bamboo seed. This seed, when planted, appears not to grow at all or to grow very slowly for the first 3-5 years - despite regular watering and care. However, one day things suddenly change- a shoot emerges from the soil and rapidly grows into a tall plant. If one had given up on the seedling, howsoever briefly, there would have been no bamboo. The plant is there only because of one's persistence because one never gave up on it. Follow what your heart tells you to do; have faith, be authentic, and work with purpose -and you will attain your goal, your heart's goal. Growth in life, just as for the bamboo seed, takes immense patience and almost impossible persistence. Whether you follow your heart or you do not, success will come. But if you follow your heart, you will not only have success but will also never have any regrets. If you do not follow your heart, you will lead a 'successful' life, but a false life. We have only one life and limited time - so let us not waste this time living someone else's life.

While asking you to follow your chosen path, I must also caution you not to be so fixed in your intentions. You need to maintain a certain degree of intellectual nimbleness- being ready to seize a new opportunity when it comes along, as well as to create your opportunities. In the current era of rapid changes in science and technology, several professions are undergoing rapid transformation, and hence the ability to change with the changing time is an important attribute.

Second, your achievement today comes with social and societal commitments. We must remember that, in life, values are more important than money. You have been fortunate to have the opportunity to receive a good education. Not everyone is. Each of us needs to be cognizant of this and to work towards not only one's personal ambitions but towards the upliftment of the entire community around oneself. Each of us wants to be wise, mighty, and wealthy. What does that mean?

Who is wise? It does not know everything. Instead, a good answer is, "The person who learns from all people." Right here in this hall, others may see things very differently than you do, beliefs are at odds with your own. Wise persons seek out people who are different from themselves and learn from them. Wisdom lies in tolerance listening to others and respecting others.

Who is mighty? "The person who exercises self-control". Power is of no use if it is used indiscriminately. Instead, it needs to be channelized properly. The real power is not used to benefit oneself but to benefit mankind.

Who is wealthy? "The person who rejoices in his or her portion", i.e. one who is contended. As

Mahatma Gandhi said, "The world has enough for everyone's needs, but not enough for anyone's greed". Remember, we in this room are among the haves. All of you are young and healthy, and most of you will be among the top 1% of our population in terms of income. We need to be considerate about the older, the feebler, the poorer. Use your education to benefit disadvantaged people -that is what matters in the long run.

For those of you who have trained in healthcare fields, remember that Medicine is not only a profession, but it is also a calling. Since times immemorial, doctors have had a higher purpose in life. That does not change, that should not change, and that cannot change -- not even in today' mammon-enamoured world. As a doctor, you are unlikely to starve. You should have enough to live. Having attained that state, why should we not use our lives to help others?

Third, your education does not end today. What has come to an end is 'classroom instruction', and not 'education'. As Henry Ford, the founder of Ford Motor Company and developer of mass production techniques said: "Anyone who stops learning is old, whether at twenty or eighty. Anyone who keeps learning stays young. We all want to remain young as long as possible- don't we? Hence, each of you must continue to read and learn something new every day for the rest of your life. I sincerely hope you will.

Finally, let me end with a quote from Dr. Nelson Mandela. He said, "Education is the most powerful weapon that one can use to change the world." I wish and hope that you will combine the practice of the knowledge that your teachers and institutions have equipped you with, with empathy and compassion -- to alleviate human suffering and to improve mankind, and not merely to earn money.

My best wishes to all of you for successful careers - careers and lives that your families, your friends, your teachers and your institution will be proud of.

Thank you for your patient listening.

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CAMPUS NEWS

National Seminar on Teacher Education

The one-day National Seminar on 'Teacher Education in India: A Perspective on Quality with Special Reference to NAAC and State Level Meeting of Special Interest Group on Environmental Education' was organised by the Gopal Chandra Memorial College of Education, recently. The Convenor, Dr. Shreyashi Paltasingh, Principal, GCM College and Joint Secretary, AIAER (WB Chapter delivered the welcome address where she stated that the seminar aimed to offer insights and experiences on the latest trends in teacher education based on the recommendations of NEP─2020. She also expressed her gratitude and appreciation to all the experts, eminent guests, and the teaching, non-teaching staff as well as the students of the college for their valuable contribution to making the seminar successful.

The event was inaugurated by Ms Chandrima Bhattacharya, President, Governing Body, GCM College of Education, and Minister in Charge (Finance), Government of West Bengal. In her Presidential Address, she assured her unceasing support for the all-round development of the college.

During the Technical Session, Guest Speaker, Prof. Ramakanta Mohalik, Department of Education, RIE (NCERT) presented his deliberation on the topic, 'Quality Teacher Education through NAAC in the Context of NEP-2023' where he talked about Integrated Teacher Education Programme, recommendations, visions and changes in NEP-2023, and inclusive and equitable education. He brought forth the importance of mother tongue and regional languages with a special focus on experiential learning strategy and multidisciplinary approach in education. The presentation was followed by an interactive session with the audience.

Prof. Tushar Kanti Ghara, Joint DPI, Department of Higher Education, Government of West Bengal and State Nodal Officer, AISHE presented his presentation on 'A Data Orientation for Teacher Education Institutes towards NAAC Accreditation'. Prof. Ghara delved deep into the discussion of technological advancement and data orientation and explained the strategies for systematic documentation of data for NAAC assessment and accreditation. The lecture was followed by an interactive session with the participants.

Swami Tattwasarananda, Principal, Probationer's Training Centre, Belur Math made his deliberation on 'Maintenance of Quality in Teacher Education with Reference to NAAC'. He provided valuable guidance on the parameters of NAAC and how institutions can work innovatively to fulfil the parameters constructively. The lecture was followed by an interactive session with the audience.

Prof. Debi Prasad Mishra, Director, NITTR and President, AIAER (West Bengal Chapter) spoke on the 'Role of National Assessment and Accreditation for Improving Quality of Education'. He actively interacted with the participants and enriched the audience with his innovative insights.

Dr. Bijan Sarkar, Professor, Department of Education, University of Kalyani, and General Secretary, AIAER, West Bengal (Chapter) enriched the participants with his priceless presentation on 'Environmental Education'. He also delineated the themes of BTAE (Better than Average Effect) and SSB (Self-serving Bias) in the course of his deliberation. He concluded his lecture by suggesting a book titled 'How Much Should a Person Consume' for developing sustainable environmental temperament within everyone present. Prof. Sarkar's deliberation was followed by a State Level Meeting of AIAER Special Interest Group (Environmental Education).

In the Valedictory Session, the participants and paper presenters received their certificates from Dr. Monoj Das, Former Professor, NITTR and active member of AIAER (WB Chapter). Finally, Dr. Paramita Bandopadhyay, Associate Professor proposed the Vote of Thanks and expressed her heartfelt gratitude on behalf of the college to all experts, participants, staff members and students of the college. The seminar concluded on a solemn note with the singing of the National Anthem.

International Conference on Energy Materials and Devices

A three-day International Conference on 'Energy Materials and Devices' is being organized by the

Department of Physics (MMV), Banaras Hindu University, Varanasi from March 19-21, 2024.

The fast technological developments in different fields come up with a demand for new energy devices that not only require technology-specific electrochemical performance but also demand for energy devices to be flexible, safe for human beings (for implanted and wearable equipment), eco-friendly, and economical. Much dedicated research is needed to meet the fast-increasing demand for energy devices with new characteristics. This could be achieved by frequent meetings of energy device researchers from different spheres to discuss the new understandings/ developments. The Topics of the Event are:

- Salt-in-Polymer-Electrolytes.
- Polymer-in-Salt-Electrolytes.
- Gel Electrolytes.
- Composite Electrolytes.
- Glass Electrolytes.
- Biopolymers.
- Nanomaterials for Energy Devices.
- Aqueous/ Non-aqueous Liquid Electrolytes.
- Electrode Materials.
- Bio-waste-based Electrodes.
- Graphene-based Electrodes.
- Lithium Battery Electrodes.
- Other Alkali Battery Electrodes.
- Batteries.
- Solar Cell.
- Fuel Cells/ MFC.
- Supercapacitors, etc.

For further details, contact Convener, Department of Physics (MMV), Banaras Hindu University, Varanasi–221005 (Uttar Pradesh), Mobile No: 09415424782, E-mail: *icemd2024@gmail.com.* For updates, log on to: *https://www.icemd2024.com/*

National Conference on Communication

A four-day National Conference on 'Communications' is being jointly organised by the Indian Institute of Technology Madras, Chennai, Tamil Nadu and Indian Institute of Technology Tirupati, Andhra Pradesh from February 28- March 02, 2024. The Topics of the Event are:

Communications

- Communications Theory and Systems.
- Information and Coding Theory.
- Wireless Communications.
- Satellite and Space Communications.
- Quantum Communications and Computing.
- Security and Privacy Issues in Communications.
- Smart Grid and Power line Communications.
- Edge Communications.
- Machine Learning/AI-based Solutions for Wireless Communications.
- Energy Harvesting and Green Communications.
- Molecular, Biological and Multi-scale Communications.

Signal and Image Processing

- Adaptive Signal Processing.
- Biomedical Signal Processing.
- Detection and Estimation.
- DSP Implementation and Architectures.
- Graph Signal Processing.
- Image, Multimedia and Video Signal Processing.
- Secure Signal Processing.
- Pattern Recognition and Machine Learning.
- Optimization for Signal Processing.
- Quantum Signal Processing.
- Speech, Audio, and Language Processing.
- Sparse Signal Processing.
- Graph Signal Processing.
- Applications in Astronomy/Astrophysics.

Network and Learning Theory

- 5G/B5G/6G/Next-generation Networks.
- Wireless and Wireline Networks.
- Quantum Networking.
- Big Data, Machine Learning and AI for Networks.
- Biological Networks.
- Cloud and Fog/Edge Computing and Networking.
- Complex Networks/ Social Networks.
- Cyber-physical Systems / IoT.

- Network Economics and Pricing.
- Network Security and Privacy.
- Sensor and Ad-hoc Networks.
- Software-defined Networking.

RF and Optical Communication

- Microwave Devices and Meta Surfaces.
- Antennas and Phased Arrays.
- Microwave/mm-Wave/TeraHertz Communication and Imaging.
- Optimization and Machine Learning Aided Design of Antennas and Microwave Components.
- Radars, Remote sensing and Wireless Power Transfer.
- Optical Communication.
- Optical Networks and Systems.
- Optical Network Security.
- Visible and IR Free-space Optical Communication Systems.
- Optical Interconnect Technologies.

For further details, contact General Chair of the Event, Indian Institute of Technology Madras, Chennai –600036. E-mail: *krishnaj@ee.iitm.ac.in / uday@ee.iitm.ac.in.* For updates, log on to: *www.iittp.ac.in/ncc2024.*

International Conference on Public Policy, Governance and Administration

The one-day International Conference on ‘Public Policy, Governance and Administration in Post-Pandemic Era’ is being organized by the Lovely Professional University, Phagwara, Punjab on April 26, 2024.

Public policy plays a crucial role in forming the guidelines and principles of a society, so they’re a necessary part of governing and politics. Since public policy is formed as a collective effort between governments, institutions, and even regular citizens, it’s an important and effective way to have your voice heard. Public policy is there to influence how other important decisions are made, and it’s usually formed as a response to a specific issue that is of interest to the public. Public policy is supposed to offer some sort of solution to a problem. Public Policies and Governance indicate the planning, implementing, and enacting of laws, and adapting of acceptable behavior by the government and citizens to increase the integrity of the society. It is important to recognise the importance of leadership roles Public Administrators have played in the COVID-19 pandemic and many policy initiatives taken after the pandemic. The Subthemes of the Event are:

Public Policy

- Public Policy Concept, Significance and Scope.
- Evolution of Policy Sciences.
- Different Types of Public Policy.
- Policy Transfer.
- Policy Analysis.
- Public Policy Approaches and Models.
- Public Policy Implementation, Monitoring and Control.
- Public Policy Evaluation.
- Changing Nature of Public Policy in Post-Pandemic Era.

Good Governance and Sustainability

- Elements and Forms of Good Governance.
- Public Choice Theory.
- New Public Management.
- New Public Service.
- Networking and Collaborative Governance.
- Business Process Re-engineering.
- Ethics and Public Accountability in Governance.
- Sustainable Governance Mechanism.
- Governance in the Post-Pandemic Era.

Citizen Engagement and Digital Transformation

- Citizen and Governance.
- E-Governance.
- Digital Revolution in Governance.
- Digital Literacy.
- Civil Society.
- Citizen Participation.
- Right to Information.
- Administrative Reforms.
- Citizen’s Charter.
- Citizen Grievance Redressal Mechanism.

- Challenges and Opportunities of Digital Transformation in the Public Sector.

Media and Public Administration

- Social Media and Public Administration.
- Public Relations Management.
- Media and Public Sector Administration.
- Public Administration, Society, and Media.
- Mass Media and the Imaging of Public Administration.
- Challenges of Media and Public Administration.

Disaster Management and Governance

- COVID-19, Disaster Management and Governance.
- Types of Disaster Management.
- Disaster Management Cycle.
- Importance of Disaster Management and Governance.
- Vulnerability Analysis and Risk Assessment.
- Institutional Arrangements for Disaster Management.
- Role of State and Non-state Actors in Disaster Management and Control.

For further details, contact Organising Secretary, Dr. Manvendra Singh, Associate Professor, Department of Government and Public Administration, School of Humanities (Social Sciences and Languages), Lovely Professional University, Phagwara, Punjab - 144411, Mobile No: 09166038829, E-mail: *ppgappe@lpu.co.in*. For updates, log on to: *www.lpu.in*

International Conference on Operations Research and Game Theoretic Approach

A three-day International Conference on 'Operations Research and Game Theoretic Approach in Decision Making' is being organized by the Indian Statistical Institute, Delhi Centre from January 17-19, 2024. The event will be organized as a part of the Golden Jubilee Celebrations of the Indian Statistical Institute, Delhi Centre and it intends to review the current issues in the theory and applications of Operations Research and Game Theory to problems in business and industries. The event aims to provide a forum for new developments and applications of Operations Research and Game Theory. Leading scientists, experienced researchers and practitioners, as well as younger researchers will come together to exchange knowledge and to build scientific contacts. The Topics of the Event are:

- Operations Research problems in Statistics.
- Portfolio Optimization.
- Linear and Nonlinear Programming.
- Decision Theory and Multiple Criteria Decision Making.
- Dynamic Programming.
- Simulation and Statistical Modeling.
- Inventory Theory and Applications.
- Non-smooth Optimization.
- Graph Theory in Operations Research.
- Complementarity Problems and Variational Inequalities.
- Stochastic Optimization.
- Traveling Salesman Problem.
- Knapsack, Vehicle Routing and Scheduling Problems.
- Static and Dynamic Games.
- Operations Research Problems in Reliability.
- Game Theoretical Applications of Operations Research.
- Financial Optimization.

For further details, contact Prof. S K Neogy, Chair of the Event, Indian Statistical Institute, Faculty Block, 7, SJS Sansanwal Marg, New Delhi-110016, Phone No: 011-41493966 / 011-41493968, E-mail: *icorgtdm24@isid.ac.in* and *sknisid@gmail.com*. For updates, log on to: *http://www.isid.ac.in/~icorgtdm24/*

AIU News

Development Programme on Enabling Entrepreneurship, Start-up, Incubation and Innovation Mindset

A five-day Faculty Development Programme on ‘Enabling Entrepreneurship, Start-up, Incubation and Innovation Mindset’ was organised by the Association of Indian Universities (AIU)─Academic and Administrative Development Center (AADC), Guru Gobind Singh Indraprastha University, New Delhi from June 12-16, 2023. More than 100 participants/attendees from several Institutes/ Colleges throughout India participated in the event. Dr. Amit Prakash Singh and Dr. Mansi Jhamb were joined as Guest Speakers. Dr. Singh’s talk revolved around establishing an entrepreneurial ecosystem in the university. He highlighted the key elements essential for this ecosystem, including student training, entrepreneurship promotion, and startup support. Dr. Singh emphasized training students in entrepreneurial skills and cultivating a culture of innovation. He proposed an incubation center that indirectly funds prototypes by procuring equipment for development, thus easing financial constraints on startups. He stressed the significance of an Intellectual Property Rights (IPR) cell to facilitate patent submissions by students, scholars, and faculty.

Furthermore, Dr. Mansi Jhamb shared insights into startups within the semiconductor space. Her presentation elucidated the challenges and opportunities within this sector, showcasing real-world examples of entrepreneurial endeavors. The session concluded with participants gaining valuable insights into fostering an entrepreneurial ecosystem and understanding the role of an incubation center and IPR cell in supporting startups. Dr. Singh and Dr. Jhamb’s expertise greatly enriched the discourse on entrepreneurship and innovation within the university context.

During the Technical Session, Mr. Mukesh Mohan Gupta explained the challenges faced by MSMEs and startups in India along with the opportunities. He also explained the ways to efficiently choose the location of the business and the actions to be taken before starting the business. At the end, the speaker also stated the complete process of registration of a startup and its associated benefits. The next session was focused on various government schemes floated by GoI for startups and MSME like Startup India Fund Scheme, CGSS, CGTMSE, Standup India, etc. The speaker explained each scheme in detail for the benefits of the participants, and also explained various other benefits for MSEs in public procurements. While concluding the session, the question-answer session was also conducted, where various queries of the participants regarding startups were taken up and doubts were cleared.

Prof. Yogesh Brahmankar, CEO, Symbiosis Technology Business Incubator explained the mindset required in entrepreneurial and he also stated that entrepreneurship is not magic. He explained by giving the examples of entrepreneurs of younger age where the motivation is to bring new ideas, and new products, observe something, and then execute them. Innovators and Intrapreneurs in academics are required to make the change happen. He suggested that time and resources should be given to the students by the faculty members for experimenting, iterating, and executing new ideas. He believed that research should be based on an environment where there is a deeper understanding of the problems faced in our surroundings. He explained in a detailed manner about the entrepreneurial ecosystem. In the end, he also stated the complete process of registering the patent and the policies for innovation of a startup and its associated benefits. The next session was focused on key areas of NISP where he explained each factor along with the examples. He stated that all opportunities are available for faculty members in the field of innovation. He provided ideas for the innovation as an incubator. While concluding the session, the question-answer session was also conducted where various queries of the participants regarding innovation were taken up and doubts were cleared.

Ms. Sanjana Govindam, Programme Head, Women’s Entrepreneurship Programme, NITI Aayog, Govt of India began the session by discussing the role of women entrepreneurs, especially in India. She discussed the HITS and MISSES of the entrepreneurial ecosystem efforts in India for women-led development. She further discussed in detail WEP, i.e. Women Entrepreneurship Platform which is a unique platform built on Public Private Partnership facilitated by ecosystem players to address ecosystem gaps. In addition, Ms. Sanjana explained the model of effective mentorship to understand access, awareness, experience, and value derived from mentorship. The session was quite informative and encouraged women's entrepreneurship. The next session was taken by Ms. Deepali Upadhyay, Programme Director, Atal Innovation Mission, NITI Aayog, Govt of India. She started by giving a brief information about the Atal Innovation Mission (AIM). She discussed in detail the six programmes under AIM namely, Atal Tinkering Labs (ATLs), Atal Incubation Centers (AICs), Atal Community Innovation Centers (ACICs), Atal New India Challenge (ANIC)/Applied Research and Innovation for Small and Medium Enterprises (ARISE), Mentor India, and Vernacular Innovation Program (VIP). She further explained the different phases of the Innovation Lifecycle and mapping of the above-mentioned programmes with the different phases. Ms. Deepali showed a very inspiring video of one of the ATL incharge who appeared on a famous television show, KBC. She then discussed the ACIC model. Lastly, she discussed the Mentor India programme and showed various reputed mentors that are associated with the same. A question and answer session was also conducted at the end of each session where the participant's doubts were cleared by the respected speakers.

Prof. Sudhir K Jain gave the introduction of Intellectual Property Rights (IPRs) and explained their importance for Entrepreneurs, Startups and MSME's. He discussed the major forms of Intellectual Property Rights like Patents, Industrial Designs, Trademarks, Copyrights, Layout Design of IC's, Trade Secrets, Plant Varieties, and Geographical Indications. He also explained about the Paris Convention held in 1883 and the Bern Convention held in 1886. He also explained that within one product multiple IPRs may be associated and each IPR is protected under different laws. Then, he explained the goals of the IPR system: more inventions leading to a better life, better R&D culture, creative employment generation, better utilization of natural resources, economic development, more global trade, etc. Then, he explained about GATT (General Agreement on Tariffs and Trade) introduced in 1947. The General Agreement on Tariffs and Trade is a legal agreement between many countries, whose overall purpose was to promote international trade by reducing or eliminating trade barriers such as tariffs or quotas. GATT was replaced by the WTO (World Trade Organization) in 1995. The WTO covers services and intellectual property as well. The WTO dispute settlement system is faster, and more automatic than the old GATT system. WTO is more preferred because of the reduction in customs duties, and globalization. He also mentioned that the National IPRs Policy was introduced in 2016. The policy encourages creativity, innovation, and entrepreneurship in India. It keeps a check on the theft of one person's innovation by another. Then he explained about some important patents namely Calculator, Printing Press, Air Conditioning, Camera, etc. He also explained some IPR legislations such as The Patents Act in 1970, The Designs Act in 2000, The Trademarks Act in 1999, the Copyrights Act in 1957, etc. Then, he explained about Patent by giving its definition and some examples and he also explained about how one can file a patent, and what is the form of application for filling a patent. Towards the end of the session, he briefly explained all the major forms of IPRs mentioned above. At last, the doubts from the participants were resolved by the speaker.

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THESES OF THE MONTH

SCIENCE & TECHNOLOGY

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

AGRICULTURAL & VETERINARY SCIENCES

Horticulture

1. Singh, Rajmani. **Effect of integrated nutrient management on growth, flowering and yield of African marigold (*Tagetes erecta* L) CV. Pusa Narangi Gainda**. (Prof. M L Meena), Department of Horticulture, Babasaheb Bhim Rao Ambedkar University, Lucknow.

BIOLOGICAL SCIENCES

Bio Science

1. Nitin Kumar. **Extraction and characterization of bioactives from Giloy (*Tinospora Cordifolia*) and its application in herbal yogurt formulation**. (Prof. J K Sahu and Prof.S N Naik), Centre for Rural Development & Technology, Indian Institute of Technology Delhi, New Delhi.

Biotechnology

1. Dave, Upma. **Role of E121K mutation of D-amino acid oxidase in amyotrophic lateral sclerosis**. (Prof.Jamesh Gomes), Kusuma School of Biological Sciences, Indian Institute of Technology Delhi, New Delhi.
2. Hans, Nidhi. **Valorization of algal biomass by extracting bioactive compounds using supercritical CO_2 and subcritical water extraction process**. (Prof.S N Naik and Prof. Anushree Malik), Centre for Rural Development & Technology, Indian Institute of Technology Delhi, New Delhi.

Botany

1. Bimjiyani, Vidhi Hitesh. **Development of green process for extraction of bioactive compounds from flaxseed**. (Prof. S N Naik and Prof. A K Dalai), Centre for Rural Development & Technology, Indian Institute of Technology Delhi, New Delhi.

Life Science

1. Dixit, Anjali. **Investigating the biophysical properties and aggregation behaviour of optineurin and its mutants**. (Prof.Bishwajit Kundu), Kusuma School of Biological Sciences, Indian Institute of Technology Delhi, New Delhi.
2. Priya, Anjali. **Novel membrane active peptides derived from marine organisms and their mechanisms of action**. (Prof. Archana Chugh), Kusuma School of Biological Sciences, Indian Institute of Technology Delhi, New Delhi.

EARTH SYSTEM SCIENCES

Environmental Science

1. Fasake, Vinayak Dattatray. **Developing non-wood paper and optimizing for rural scale packaging**. (Prof. Kavya Dashora), Centre for Rural Development & Technology, Indian Institute of Technology Delhi, New Delhi.
2. Isha, Adya. **Development of high-efficiency anaerobic digestion process of kitchen, vegetable, and fruit wastes for biogas production**. (Prof.Virendra K Vijay and Prof. Ram Chandra), Centre for Rural Development & Technology, Indian Institute of Technology Delhi, New Delhi.
3. Mishra, Rupali. **Studies on chromium transforming bacteria isolated from tannery waste disposal site of Kanpur**. (Dr. Pankaj Kumar Arora), Department of Environment Microbiology, Babasaheb Bhim Rao Ambedkar University, Lucknow.
4. Rawat, Shalu. **Utilization of waste materials for the synthesis of nano materials and their application for the removal of dyes and phenolic compounds from the water**. (Dr. Jiwan Singh), Department of Environmental Science, Babasaheb Bhim Rao Ambedkar University, Lucknow.
5. Verma, Renu. **Diversity of rhizobia associated with chickpea germplasm in relation to nodulation and nitrogen fixation**. (Dr. Naveen Kumar Arora), Department of Environment Microbiology, Babasaheb Bhim Rao Ambedkar University, Lucknow.

ENGINEERING SCIENCES

Biomedical Engineering

1. Banerjee, Ahana. **Development of biomimetic scaffolds to regulate diabetic wound microenvironment**. (Prof. Jayanta Bhattacharyya and Prof. Veena Koul), Centre for Biomedical Engineering, Indian Institute of Technology Delhi, New Delhi.
2. Chatterjee, Subhodip. **Modelling and mitigation of unexpected slips and falls in hospitals**. (Prof.Arnab Chanda), Centre for Biomedical Engineering, Indian Institute of Technology Delhi, New Delhi.
3. De, Shreemoyee. ***In-vitro* platform to study diseases**. (Prof. Neetu Singh), Centre for Biomedical Engineering, Indian Institute of Technology Delhi, New Delhi.

Chemical Engineering

1. Dwivedi, Uma. **Waste plastic conversion into high-value products using zeolite based catalysts**. (Prof. S N Naik and Prof. K K Pant), Centre for Rural Development & Technology, Indian Institute of Technology Delhi, New Delhi.

Civil Engineering

1. Majhi, Archana. **Quantifying and constraining the model uncertainty in future sub-daily precipitation projections**. (Prof. Dhanya C T and Prof. Sumedha Chakma), Department of Civil Engineering, Indian Institute of Technology Delhi, New Delhi.
2. Rajesh Kumar. **Effect of irradiation on mechanical and structural properties of borosilicate glasses**. (Prof. N M Anoop Krishnan), Department of Civil Engineering, Indian Institute of Technology Delhi, New Delhi.
3. Sarangi, Punyabeet. **Assessment of the impacts of intra-household interactions on household activity-travel behavior**. (Prof.Manoj M), Department of Civil Engineering, Indian Institute of Technology Delhi, New Delhi.

Computer Science & Engineering

1. Dahiya, Abhishek. **Designing for the other: How user persona affects design thinking**. (Prof. Jyoti Kumar), Department of Design, Indian Institute of Technology Delhi, New Delhi.
2. Goel, Kunal. **An integral approach of self-sustaining and data aggregation in real time for precision agriculture in Wireless Sensor Networks (WSNs)**. (Dr. Amit Kumar Bindal), Department of Computer Science & Engineering, Maharishi Markandeshwar University, Ambala.
3. Khatri, Yogita. **Software metric based efficient approaches for cross-project defect prediction**. (Prof. Sandeep Kumar Singh), Department of Computer Science & Engineering, Jaypee Institute of Information Technology, Noida.
4. Sakshi. **Towards enhancing security for IoT based applications**. (Dr. Avinash Sharma), Department of Computer Science & Engineering, Maharishi Markandeshwar University, Ambala.

Electrical & Electronics Engineering

1. Chaudhuri, Dipta. **Pulsed power circuits design techniques for electromagnetic launchers**. (Prof. Shouri Chatterjee and Prof.G Bhuvaneswari), Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi.
2. Bipin Kumar. **Studies on underwater directional acoustic sensor**. (Prof. Arun Kumar and Prof. Rajendar Bahl), Centre for Applied Research and Electronics, Indian Institute of Technology Delhi, New Delhi.
3. Das, Souvik. **Control of AC/DC microgrids with DFIG based wind energy conversion and solar PV generation**. (Prof. Bhim Singh), Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi.
4. Gupta, Shardha. **Investigation of traps induced reliability issues in GaN high electron mobility transistors**. (Prof. Ankur Gupta and Prof.Janesh K Kaushik), Centre for Applied Research in Electronics, Indian Institute of Technology Delhi, New Delhi.
5. Kiran Kumar. **An experimental investigation on strength and durability of vermiculate as a replacement material for natural sand in vermiculite concrete**. (Dr. B Damodhara Reddy and Dr. C Sashidhar), Department of Electronics & Communication Engineering, Jawaharlal Nehru Technological University Anantapur, Ananthapuramu.
6. Neelima, K. **Optimization of matrix codes for detection and correction of burst errors in high density memories with VLSI techniques**. (Dr. C Subhas), Department of Electronics & Communication Engineering, Jawaharlal Nehru Technological University Anantapur, Ananthapuramu.
7. Sharma, Somia. **Spoof surface plasmon polariton-based antenna**. (Prof. Shiban Kishen Koul and Prof. Ananjan Basu), Centre for Applied Research and Electronics, Indian Institute of Technology Delhi, New Delhi.
8. Sohi, Arashpreet Kaur. **Investigations on ultrawideband fractal microstrip patch antenna arrays for Mimo wireless communication applications**. (Dr. Amanpreet Kaur), Department of Electronics & Communication Engineering, Thapar Institute of Engineering and Technology, Patiala.

Electronics & Communication Engineering

1. Hathwalia, Shruti. **Novel design of a digital PLL for power reduction**. (Dr. Naresh Grover), Department of Electronics & Communication Engineering, Manav Rachna International Institute of Research and Studies, Faridabad.

Energy Studies

1. Pal, Ram Kumar. **Investigation on direct steam generation in parabolic trough solar collector**. (Prof. K Ravi Kumar), Department of Energy Science & Engineering, Indian Institute of Technology Delhi, New Delhi.
2. Singh, Indraj. **Electron and ion scale magnetic turbulence studies relevant to laboratory astrophysics**. (Prof. R Uma and Prof. R P Sharma), Department of Energy Science & Engineering, Indian Institute of Technology Delhi, New Delhi.

Mechanical Engineering

1. Choudhary, Shubham. **Development and experimental investigations into multi-jet rotary nanofinishing process**. (Dr. Ravinder Kumar Duvedi and Dr. Jaswinder

Singh Saini), Department of Mechanical Engineering, Thapar Institute of Engineering and Technology, Patiala.

2. Garg, Shital Kumar. **Experimental and numerical studies of the regenerator for a miniature stirling cryocooler**. (Prof.B Premachandran), Department of Mechanical Engineering, Indian Institute of Technology Delhi, New Delhi.

3. Gupta, Mahendra Kumar. **Design, development and performance analysis of pico-capacity hydrokinetic turbine**. (Prof.P M V Subbarao), Department of Mechanical Engineering, Indian Institute of Technology Delhi, New Delhi.

4. Kalra, Gaurav. **Optimization of process parameters to minimize workpiece temperature during 2.5D milling using artificial intelligence techniques**. (Dr. Arun Kumar Gupta), Department of Mechanical Engineering, Maharishi Markandeshwar University, Ambala.

5. Kala, Kaveri. **Waste management: A framework for intervention**. (Prof. Nomesh B Bolia), Department of Mechanical Engineering, Indian Institute of Technology Delhi, New Delhi.

6. Lalit Kumar. **Structural behaviour and failure analysis of CNT reinforced composite plates in hydro-thermal environment**. (Dr. Neeraj Grover and Dr. Gagandeep Bhardwaj), Department of Mechanical Engineering, Thapar Institute of Engineering and Technology, Patiala.

7. Yadav, Aanchal. **Extended Isogeometric analysis for fracture behaviour of CNT reinforced materials subjected to thermo-mechanical loading**. (Dr. Gagandeep Bhardwaj and Dr. Rajendra Kumar), Department of Mechanical Engineering, Thapar Institute of Engineering and Technology, Patiala.

Metallurgical Engineering

1. Bakshi, Ashok Kumar. **Processing and characterization of HDPE/plasticized UHMWPE/MWCNT nanocomposites and their foams for EMI shielding effectiveness**. (Prof. Arup K Ghosh Prof. Shib Shankar Banerjee), Department of Materials Science and Engineering, Indian Institute of Technology Delhi, New Delhi.

2. Kasimuthumaniyan, S. **Multi-scale indentation and scratch behavior of oxide glasses**. (Prof. Nitya Nand Gosvami and Prof.N M Anoop Krishnan), Department of Materials Science and Engineering, Indian Institute of Technology Delhi, New Delhi.

Textile & Apparel Design

1. Chakraborty, Juhi. **Investigation of tissue engineering and tissue 3D bioprinting strategies for the regeneration of soft and hard tissues**. (Prof. Sourabh Ghosh), Department of Textile and Fibre Engineering, Indian Institute of Technology Delhi, New Delhi.

2. Singh, Ankit Kumar. **Studies in development of novel functional dyes for tetiles**. (Prof. Javed Nabibaksha Sheikh), Department of Textile and Fibre Engineering, Indian Institute of Technology Delhi, New Delhi.

3. Yadav, Manisha. **Studies on extraction and application of pearl millet (*Pennisetum glaucum*) fibers**. (Prof. Deepti Gupta and Prof. R S Rengasamy), Department of Textile and Fibre Engineering, Indian Institute of Technology Delhi, New Delhi.

MATHEMATICAL SCIENCES

Mathematics

1. Goyal, Vandana. **Multi objective quadratic fractional programming models**. (Dr. Deepak Gupta), Department of Mathematics, Maharishi Markandeshwar University, Ambala.

2. Gupta, Mukesh. **Numerical study of (Non) linear partial differential equations via collocation techniques**. (Dr. Brajesh Kumar Singh), Department of Applied Mathematics, Babasaheb Bhim Rao Ambedkar University, Lucknow.

3. Harman Kaur. **On combinatorics and congruences for q-series**. (Dr. Meenakshi Rana), Department of Mathematics, Thapar Institute of Engineering and Technology, Patiala.

4. Namrata Rani. **Multi-objective quadratic fractional optimization models with fuzzy parameters**. (Dr. Deepak Gupta), Department of Mathematics, Maharishi Markandeshwar University, Ambala.

5. Vyas, Kishan Indravadan. **Study on sumset labeling and its variants**. (Dr. U M Prajapati), Department of Mathematics, Gujarat University, Ahmedabad.

MEDICAL SCIENCES

Biochemistry

1. Bali, Sharadendu. **Study of effects of water extracts of Nelumbo nucifera leaf in hyperlipidemic rabbits**. (Dr. Suvarna Prasad and Dr. Vipin Saini), Department of Medical Biochemistry, Maharishi Markandeshwar University, Ambala.

Physiotherapy

1. Singh, Shikha. **Development, validation and reliability testing of a sensory outcome measure for hypoxia induced cerebral palsy children**. (Dr. Vandana Esht and Dr. Astha Agarwal), Department of Physiotherapy, Maharishi Markandeshwar University, Ambala.

PHYSICAL SCIENCES

Chemistry

1. Chandra, Dinesh. **Synthesis of Aziridines and secondary amides using aminating reagents and their biological**

evaluation. (Dr. Jawahar Lal Jat), Department of Chemistry, Babasaheb Bhim Rao Ambedkar University, Lucknow.

2. Dhameja, Manoj. **Design, synthesis and biological evaluation of heterocycle based α glucosidase inhibitors**. (Dr. Preeti Gupta), Department of Applied Chemistry, Babasaheb Bhim Rao Ambedkar University, Lucknow.

3. Ram Karan. **Design, synthesis and biological evaluation of dihydropyrimidinones fused/tethered heterocycles as anticancer agents**. (Dr. Praveen Kumar Gupta and Dr. Ravindra Kumar Rawal), Department of Chemistry, Maharishi Markandeshwar University, Ambala.

4. Sharma, Shilpa. **Insights into the mechanism of aggregation of Superoxide Dismutase1 (SOD1) and its mutants in the absence and presence of small molecules**. (Prof.Shashank Deep), Department of Chemistry, Indian Institute of Technology Delhi, New Delhi.

5. Singh, Deepika. **Synthesis and evaluation of serotonin 5 HT ligands**. (Dr. Anjani Kumar Tiwari and Dr. Himanshu Ojha), Department of Chemistry, Babasaheb Bhim Rao Ambedkar University, Lucknow.

6. Verma, Saumya. **Synthetic application of oxygen substituted hydroxylamine reagents in Beckmann rearrangement**. (Dr. Bhoopendra Tiwari), Department of Applied Chemistry, Babasaheb Bhim Rao Ambedkar University, Lucknow.

Physics

1. Singla, Priyanka. **Efficient architectures and networks for energy harvesting systems**. (Prof. Smruti R Sarangi), Amar Nath and Shashi Khosla School of Information Technology, Indian Institute of Technology Delhi, New Delhi.

2. Agrawal, Mansi. **Growth and characterization of GaN nanostructures and A1GaN/GaN heterostructures for device applications**. (Prof. B R Mehta and Prof. R Muralidharan), Department of Physics, Indian Institute of Technology Delhi, New Delhi.

3. Asha Kumari. **Design and development of polymer altered liquid crystal for electro-optic and thermoelectric applications**. (Prof. Aloka Sinha), Department of Physics, Indian Institute of Technology Delhi, New Delhi.

4. Bisht, Prashant. **Synthesis, structural, gas sensing in-situ XPS and KPFM investigation PLD grown 2D materials based nanostructures**. (Prof.B R Mehta and Prof. J P Singh), Department of Physics, Indian Institute of Technology Delhi, New Delhi.

5. Gautam, Amish Kumar. **Nanostructured materials for thermoelectric devices**. (Prof. Neeraj Khare), Department of Physics, Indian Institute of Technology Delhi, New Delhi.

6. Jain, Manjari. **Unravelling optical, excitonic and polaronic effects in perovskites using many body Perturbation Theory**. (Prof.Saswata Bhattacharya), Department of Physics, Indian Institute of Technology Delhi, New Delhi.

7. Mishra, Vireshwar. **Growth and investigations of Co-based spin gapless semiconducting equiatomic quaternary heusler alloy thin films for spintronic applications**. (Prof.Sujeet Chaudhary), Department of Physics, Indian Institute of Technology Delhi, New Delhi.

8. Narinder Kaur. **Growth, structural, optoelectronic, and photoelectrochemical properties of 2D transition metal chalcogenide-based semiconductors and their heterostructures**. (Prof. B R Mehta and Prof. Rajendra Singh), Department of Physics, Indian Institute of Technology Delhi, New Delhi.

9. Pal, Bhavna. **Electro-optical and physical properties of liquid crystal molecules studied by quantum mechanical methodology**. (Dr. Devendra Singh), Department of Physics, Babasaheb Bhim Rao Ambedkar University, Lucknow.

10. Sorifi, Sahin. **Investigation of the optical and optoelectronic properties of GaSe and its heterojunctions for photodetector applications**. (Prof. Rajendra Singh), Department of Physics, Indian Institute of Technology Delhi, New Delhi. ❑

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03.	B.V.Patel Institute of Commerce (B.com, M.com)
04.	Shrimad Rajchandra Institute of Management and Computer Application (BCA, MCA)
05.	C. G. Bhakta Institute of Biotechnology
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