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RECENT SCENARIO OF HIGHER EDUCATION IN GENERAL DEGREE CHEMISTRY: PARAMETER IN IMPLEMENTING NEP 2020

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RESEARCH ARTICLE

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Abstract

The present study sought to identify ways to improve the quality and quantity of chemistry in higher educational institutions in West Bengal. It highlights the perspective of NEP 2020 and compares the existing higher education framework with the National Education Policy 2020. The study has run out the overview of the background of chemistry teaching in higher education institutions in West Bengal. It also focuses on the challenges in higher education faced by professors, students, community. The study will help the learners, policy makers, and researchers to learn about the recent scenario of higher education in chemistry in general degree colleges in West Bengal.

Keywords: *NEP 2020, Higher Education, Chemistry, Job Opportunity, General Degree Colleges, Recent Scenario*

Introduction

Education plays a pivotal role in building a strong and developed nation. A nation's economy is directly linked to the quality of its education system. India is a democratic country where equality of educational opportunity is provided to its citizens. India has the world's third-largest higher education sector, behind the United States and China. In recent years, India's higher education sector has experienced tremendous growth in many areas such as institutional capacity, enrolment and student ratio. The national education policy NEP was approved by the Union Cabinet of India on July 28, 2020, and replaced the old NEP 1986. NEP 2020 is a comprehensive framework from primary education to higher education, as well as vocational training in both rural and urban areas. NEP 2020 is guiding principles of access, equity, quality, affordability, and accountability. For higher education in particular, the new education policy proposes a systematic shift from rigid to flexible, teacher-centric to learner-centric, from content-oriented to critical thinking and research. The national education policy aims to achieve a GER of 50% by 2035. To achieve this, the government is focusing on setting up more higher education institutions, providing all kinds of support to disadvantaged students, and promoting multidisciplinary educational institutions in online and distance mode.

The state of West Bengal has had a legacy of higher education in India. West Bengal faces some of the major issues and challenges in higher education, such as gender inequality, regional disparity, access, infrastructure, student-teacher ratio, etc.

Nowadays, chemistry becomes a nightmare for students from science backgrounds because chemistry does not possess laws like Newton's law. That's why we cannot predict precisely the fate of any chemical reaction. Sometimes we get a different product, a different yield and some of us failed to carry out the reaction despite matching all conditions. Applying Newton's law, we can precisely define the trajectory and future of a particle. However, chemistry has a vast application in the field of science and it is a useful interdisciplinary subject to carry out research. A biologist needs chemistry, a physicist needs chemical systems to study the physical phenomena, and a mathematician sometimes needs a chemical system for the purpose to study a real model. The most important aspect is that chemistry creates a wide range of versatile job opportunities from academia to industry.

The present study has focused on the recent scenario of chemistry in higher education in general degree colleges, institutions and universities in West Bengal according to NEP 2020. Here we discuss different issues and challenges in implementing CCFUP of NEP 2020 in chemical education comparing to the previous NEP 1986 (1+1+1 and CBCS systems). Education policy makers face challenges in assigning credits and curricula while forming syllabus and making them useful to acquire complete knowledge along with job creation.

Objective of the study

- To study the background of higher education in Chemistry.
- To evaluate the present scene of higher education in West Bengal.
- To compare the existing higher education framework with NEP 2020.
- To complement the concept of NEP 2020.

Research Questions

The present study addresses the following research questions using empirical data collected from institutional records, university registers, and stakeholder interactions:

- What is the trend of student enrolment in Chemistry as a subject combination after the +2 level in general degree colleges of West Bengal?
- What is the current status of Chemistry education in general degree institutions of West Bengal in terms of enrolment and institutional capacity?
- What are the gaps between policy recommendations and actual implementation of Chemistry education under NEP 2020?
- What are the major challenges and emerging opportunities for Chemistry in higher education under the NEP 2020 framework?

Statement of the problem

The present study has focused on the recent scenario of chemistry in higher education in General degree colleges in West Bengal: A parameter including NEP 2020.

Method of the Study

The present study is based on both **primary and secondary sources of data** to examine the recent scenario of Chemistry education in general degree colleges of West Bengal in the context of NEP 2020.

a. Primary Data

The primary data are collected by use of discussions and interactions with students and faculty members of chemistry in selected general degree colleges. Primary data was also important with institutional records as a source of secondary data. These were registers and admission registers of Balurghat Mahila Mahavidyalaya, Balurghat College, and Suri Vidyasagar College. Moreover, Records of attendance-cum-students registers (ACSR) and examination-based records, which were procured at the University of Gour Banga and The University of Burdwan, were studied to examine the trend of enrolment, student participation and institutional capacity in teaching Chemistry.

b. Secondary Data

The secondary data were collected from in peer-reviewed research articles, academic journals, books, newspapers, government reports, policy documents, and verified educational websites. These sources were utilized to corroborate the empirical results and to place the study in the context of the wider discussion on reforms in higher education and the adoption of the National Education Policy 2020.

Limitation of the study: There may be bias in the information provided by the respondents.
The study has carried out in the colleges of the district of Dakshin Dinajpur, Uttar Dinajpur, Malda and Birbhum.

Results and Discussions

Scenario of Chemistry as a general/minor subject in Dakshina Dinajpur

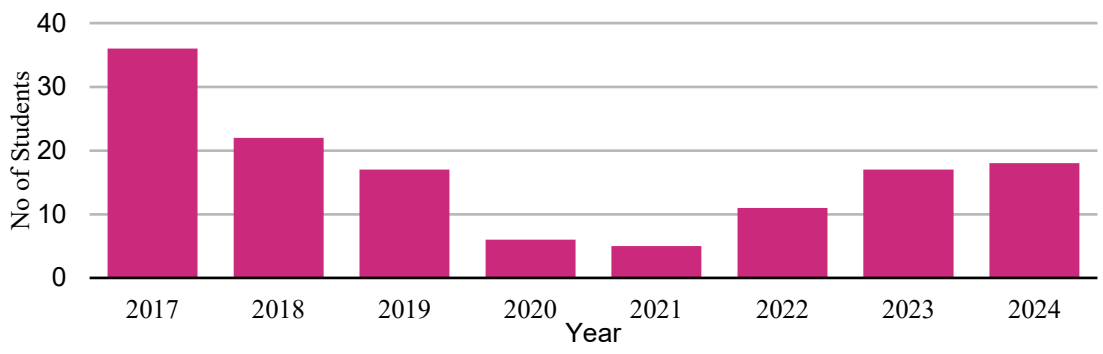

Figure 1: Year wise No of Students with Chemistry general/minor of Balurghat Mahila Mahavidyalaya

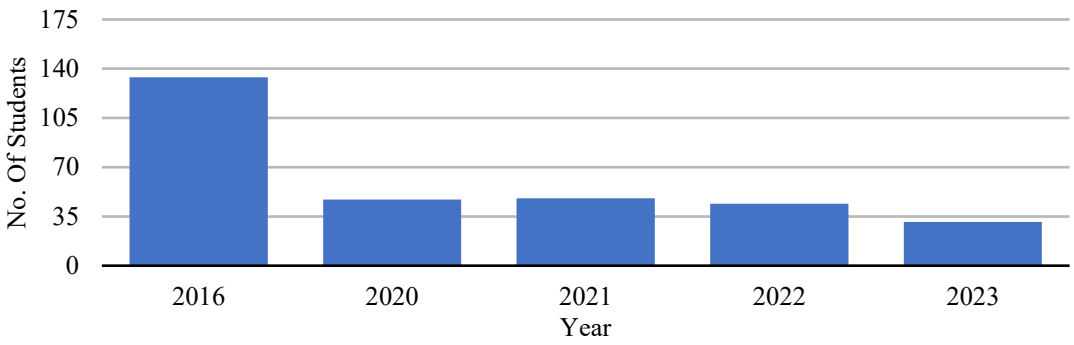

Figure 2: Year wise No of Students with Chemistry general/minor of Balurghat College

There are two colleges at Balurghat, the district headquarters of the Dakshin Dinajpur district. This district is also in the category of backward and economically weak districts and marked as zone D. Table 1 shows the details of year-wise number of students enrolled/registered with chemistry as a general/minor subject of Balurghat Mahila Mahavidyalaya. From Figure 1, it is confirmed that there is a trend in the decrease in the number, with maximum decrease during lockdown due to Covid 19. In 2019 number of students appeared in B.Sc. The 3rd year general examination was only two and both have chemistry in their combination. The number decrease during Covid 19 and increase after Covid 19 can be explained due to the flexibility of subject choice. During Covid 19 student from the Food and Nutrition Honours didn't choose chemistry; after that, they chose chemistry as a general/minor subject. A similar trend is seen in Figure 2, which depicts year-wise number of students registered in chemistry general/minor at Balurghat College. The number has decreased nearly three times (Table 2) in recent years compared to 2016. Presently, there are 7 substantive teachers in Balurghat College. Contradictory trend between Balurghat Mahila Mahavidyalaya and Balurghat College after Covid 19 can be explained by the tendency of participation of women being more than men. This is due to the Kanyashree (K2) project of the government of West Bengal. Gangarampur College is another important college in Dakshin Dinajpur and there were 61 students who appeared in the semester III general chemistry examination 2022 (year of enrolment 2021).

Table 1: Year-wise enrolment/registration details in chemistry general/minor of Balurghat Mahila Mahavidyalaya

Year of Admission	Mode of Curriculum	No of Students	Teacher Student Ratio
2017	1+1+1	36	1:18
2018	1+1+1	22	1:11
2019	1+1+1	17	1:17
2020	CBCS	6	1:6
2021	CBCS	5	1:5
2022	CBCS	11	1:11
2023	NEP	17	1:17
2024	NEP	18	1:18

Table 2: Year-wise enrolment/registration details in chemistry of Balurghat College

Year	Student No. In Hons/Major	Data Source: ACSR of	Student No. In Gen/Minor	Data Source: ACSR of	Mode of Curriculum
2016			134	Part II 2017	1+1+1
2020			47	Sem IV 2022	CBCS
2021	9		48	Sem II 2022	CBCS
2022			44	Sem IV 2024	CBCS
2023	32	Sem I 2023	31	Sem I 2023	CCFUP-NEP 2020

Statistics of University of Gour Banga, Malda, WB: There are very few data collected about University of Gour Banga (UGB), which comprises 25 colleges of Malda, Dakshin Dinajpur and Uttar Dinajpur Districts. Table 3 represents the number of students who appeared in the B.Sc. Honours Semester VI Examination 2024 under the CBCS curriculum of most of the colleges where chemistry has been taught in honours/major level. Yet the number is very low. However total number increased after the implementation of CCFUP-NEP 2020 because of the flexibility of choosing chemistry as a major. The total number of students in the general stream of the same batch is 224, who have chemistry in their subject combination.

Table 3: Number of Students appeared in B.Sc. Honours Semester VI Chemistry Examination 2024 under CBCS of various Colleges University of Gour Banga

Institution	District	No of Students
Balurghat College	Dakshin Dinajpur	9
Gour Mahavidyalaya	Malda	7
Raiganj Surendranath Mahavidyalaya	Uttar Dinajpur	3
Malda College	Malda	3
Kaliyaganj College	Uttar Dinajpur	5
Meghnad Saha College, Itahar	Uttar Dinajpur	7

In part 2 or semester IV, there were two centres of practical chemistry examination of UGB and Table 4 shows the details of the Balurghat College centre.

Table 4: Candidates' details in Balurghat College Practical Centre of UGB

Examination	No. of Candidates
Part 2 2019	36
Sem IV 2022	38
Sem IV 2023	18

Studies in Honours/Major Chemistry Course of Suri Vidyasagar College, Birbhum, WB: Suri Vidyasagar College is a prime college in Birbhum district under the affiliation of The University of Burdwan (BU). There are five substantive teachers along with one graduate-level instructor (GLI) and two state-aided college teachers (SACT). The current overall teacher-student ratio is 1:7.63. Table 5 and Figure 3 illustrate year-wise enrolment and the trend of enrolment. 11 students appeared in B.Sc. Semester VI Honours Examination 2025, which is 5.1 % of all colleges under the affiliation of BU. There are a total of 217 candidates among 63 colleges, which is also an alarming sign. A similar trend in the number of students is also observed, as in the case of Balurghat Mahila Mahavidyalaya and Balurghat College. The number increased when the NEP 2020 curriculum was implemented because it removes barrier in choosing chemistry.

Table 5: Suri Vidyasagar College

Year of registration	No of Students
2017	25
2018	21
2019	12
2020	6
2021	3
2022	11
2023	12
2024	17

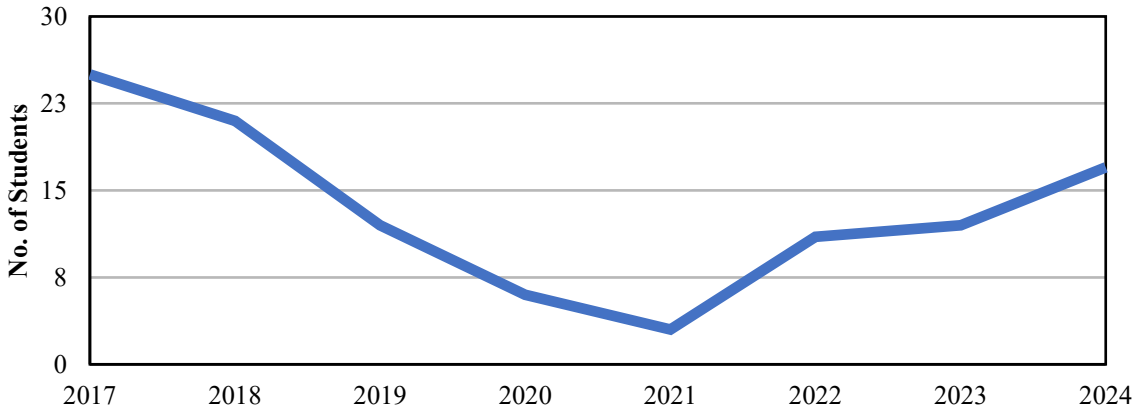

Figure 3: Year wise enrolment in chemistry honours/major course in Suri Vidyasagar College

Challenges of implementing NEP 2020 in Chemistry: After discussion with professors (nearly 153 professors) and students of different institutions, we have pointed out the following parameters.

A large number of teachers and subject availability in institutions: NEP 2020 removes the barrier to choosing disciplines. In India, the number of colleges with a single or no teacher or no substantive teacher in a subject is significantly high. Most of the colleges do not have a variety of subject combinations and the number of teachers is not enough. With that much scarcity of teachers, as well as discipline, inhibits smooth implementations of NEP 2020. Teacher students ratio in many institutions is not satisfactory.

Infrastructure: Chemistry is always associated with rigorous laboratory work. During the syllabus transition from the 1+1+1 system to the CBCS system, many new practical topics were included. Practically, those practical classes never materialised in many institutions due to a lack of infrastructure. After that NEP 2020 syllabus is composed of some practical which need very expensive research instruments as well as chemicals. Most of the academic institutions need funding for the real implementation of NEP 2020 in chemistry.

Teachers' training: There are a lot of new and advanced topics in the chemistry syllabus of NEP 2020, which belong to different specialisation areas. Those topics are in extreme demand for application-based as well as research-oriented studies. Chemistry teachers usually have specialisations in inorganic, physical, organic, industrial, medicinal and analytical chemistry according to the previous concept. Knowledge of other specialisation are excluded naturally because of barriers in the previous framework. For example, only physical chemistry teachers learned computational chemistry and IT skills for chemistry papers of the syllabus of NEP 2020 (in most cases, not all physical chemistry teacher don't know those also). For the demand of NEP 2020, there should be a training program through short courses and for better implementation of those courses these should carry a weightage in the Career Advancement Scheme (CAS). Another aspect is that, in general, degree college teachers are not recruited on the basis of specialisations in many states and this creates an uneven distribution of chemistry teachers in colleges.

Institutional and Industrial collaboration: In semesters 7 and 8, many university syllabuses include an internship or research project/ dissertations. Most of the undergraduate colleges lacks of research facilities. To fulfil the criteria, the colleges should get enough funding for research, or they should collaborate with research institutions, industry and universities. The policy should be designed accordingly. If teachers of undergraduate colleges become part of a large cluster project with a principal investigator belonging to a research institution or universities then there will be a fair provision to implement that part of NEP 2020.

Time management according to the Academic Calendar: As in 1+1+1 (yearly examination) systems, we didn't get enough time to teach deep conceptual aspects of all topics. CCFUP NEP-2020 consists of semester examination systems. In a semester, one can get hardly 4.5 months for teaching. In practical many examination occurs up to two months later than the scheduled time in the academic calendar, so in many cases, students get only two months to cover the whole syllabus. This is because academic institutions are used for elections, teachers also have to be involved in this process, and in other public interest work, rather than academic activities.

Discussions

Reason of decreasing trend in the number of students

Lack of Employment: Students in the mentioned sample area are from poor family backgrounds. In most cases, their average family income does not exceed Rs. 15000 per month. Therefore, they choose chemistry as a discipline in their education curriculum to get better employment. Previously major portion of students who have chemistry either in their major (honours) or minor (general/subsidiary/pass) subject combination choose to become teachers in secondary, upper primary schools. Students in the high marks/merit category preferred to take higher education (post-graduation, PhD) and qualified for national-level eligibility or entrance examinations. After that, many of them got employed in higher educational institutions or research institutions. The rest of them got absorbed in various research and development departments in both government and private sectors. Very few of them became entrepreneurs as well as industrialists. Thus, they uplifted their social as well as economic status. Nowadays scope of employability has shrunk due to various reasons. Previously, examination of the School Service Commission was held every year in West Bengal till 2016 and the process of employment was going on in a continuous manner. Then various discrepancies occurred and the process was ceased due to legal litigation. Several Public Interest Litigation (PIL) were filed against that procedure. Then recruitment in secondary, higher secondary and upper primary schools was stopped. So the tendency of admission in general degree courses decreases afterwards. The previous data reflects the facts. After several interventions of opposition parties and several organisations, the whole panel of 2016 was cancelled by honourable Supreme Court of India in 2025. About 25,753 teachers lost their jobs. In Uttar Pradesh, a panel of 69,000 assistant teachers was cancelled by the Allahabad High Court in September 2024, but the Supreme Court stayed the decision. THE BPSC TRE 3.0 examination was cancelled due to allegations of paper leak in Bihar. In Karnataka provisional recruitment list for graduate primary teachers was cancelled by the High Court in 2023. Above all, a recent trend is observed to recruit teachers in higher educational institutions on a contractual basis and guest teachers with very low wages compared to an unorganised daily labourer. These incidents made a deep impact on general degree courses in various educational institutions and infused job insecurity and social disrespect.

Lack of Research Funding: Students with a strong academic background preferred to pursue a PhD degree in universities and research institutions. During their PhD, most of the full-time research scholars used to get fellowship from CSIR, UGC, DBT,

ICAR, project of individual faculties, non-NET fellowship from institutions and various bodies. Ministry of HRDC crunched the research funding (roughly 50%) in science and technology after 2014, and the scope of research, as well as getting a fellowship, decreased significantly. The Maulana Azad National Fellowship (MANF) scheme has been discontinued by the Ministry of Minority Affairs for new applicants starting from the 2022-23 academic year. Current observation implies that the number of research scholars has decreased significantly. There were around 85 research scholars till 2020 in the Department of Chemistry, Visva Bharati university but the number has decreased to half currently. This is a direct reflection of the decreased number of students in the undergraduate level, lack of job opportunities, need for proper career counselling and popularity of the subject.

Effect of GIG economy: Students are often involved in temporary, contractual and freelance work while they are studying. It is easier for them to acquire a graduation degree with easier subject combinations. Moreover number of professional institutions increases and the number of seats in medical colleges, engineering colleges, nursing colleges and pharmacy was increased tremendously. Students and parents always prefer to go for those professional degrees to secure a job future. Concomitant vacancy in chemistry, physics, biological sciences and also in some highly demanding subjects, e.g., computer science, biochemistry, and environmental science reduced.

Probable way of outcome: NEP 2020 was framed in such a way as to withdraw various restrictions in choosing chemistry. The increased number of students was reflected in our studies. There are lots of scope in CCFUP NEP 2020 where a student is involved in a professional development program. There are many courses where a student can gather knowledge about information technology, application-based computational chemistry, industrial training, and pharmaceutical knowledge. That knowledge surely helps the students to get better placements. Besides this student should do their internship in reputed research institutions with available fellowships. They should be familiarised with eminent scientists and stalwart chemists through various seminars, conferences, and workshops. Career counselling program and orientation program should be carried out in undergraduate colleges and also in higher secondary schools to aware the students about the range of opportunities in chemistry to get excellent job profiles. In this way, chemistry can be popularised while implementing NEP 2020.

Conclusion

Recent trends and scenarios of chemistry/ chemical sciences were discussed in the light of NEP 2020. We have shown many students in various institutions during the transition period from 1+1+1 to the CBCS system and from CBCS to CCFUP NEP 2020. A drastic reduction was observed throughout all datasets. The drop was maximum during Covid 19 lockdown. After that slight rise was observed at the implementation period of NEP 2020. Several challenges were discussed about the implementation of the chemistry discipline in the NEP 2020 curriculum. Insufficient infrastructure, lack of funding, few number of teachers may be a big challenge, along with a shortage of time to cover the whole syllabus. Contemporary issues and incidents have also deep impact. However solution also lies within the new NEP 2020. Different opportunities, outcomes are expected despite all barriers. NEP 2020 has the spirit of an application-based, research-centric learning approach, which can help to grow the economy of our country. Knowledge based economy is the most important pillar for India to be a developed country.

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