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## REVIEWER BOARD

## From the Desk of the Chief Editor

Dear Readers,

Over the last quarter, I have noticed a slow but significant change in the way researchers at our university carry out their work. More and more, they are drawn to issues that not only describe a situation but also try to figure out the forces that shape it. The discussions about research are more and more focused on the impact of new technologies, changing learning habits, the environment, and societal inequalities on the content and methods of scholarly inquiry. For example, artificial intelligence is not considered merely a means to cost-saving efficiency, but rather a phenomenon that needs to be carefully studied in terms of creativity, authorship, ethics, and cognitive development. Similarly, researchers in education, social sciences, and humanities are becoming more and more enthusiastic about gaining the experience of the field, the qualitative aspect, and the collaboration of different disciplines, which is a sign of their shift from working in isolation towards research that takes into account the complexity.

Omniscient is still within this bigger setting, constantly defining itself more and more as a journal that appreciates clarity of purpose, seriousness of intent, and originality that is based on thoughtful reflection. We are supporting scholars who move beyond the immediate output and show a sustained engagement with ideas. The journal is becoming more and more a place where researchers not only see themselves responsible for the correctness of their results, but also for the moral side of their intellectual process. That move already has some expectations: that authors have a broad reading, challenge their own assumptions, revise their work carefully, and consider research as a valuable addition to the common pool of knowledge and not as a personal achievement. These expectations are not limitations, but rather invitations to carry on with a work that lasts beyond the time of the deadline and is still meaningful beyond the publication.

At the same time, I recognise the pressure many scholars feel to publish quickly, often before their thinking has fully matured. I hope that Omniscient can serve as a reminder that research gains strength not from urgency, but from patience and depth. The work that leaves a lasting mark is seldom produced in haste; it is developed through careful reading, disciplined writing, and the willingness to refine and re-evaluate. When researchers allow themselves this time, their studies not only meet academic standards, but they also help set them. As editors and reviewers refine our processes, we aim to support writing that shows intellectual honesty, methodological coherence, and conceptual clarity, while encouraging authors to be ambitious in the questions they choose to pursue.

I am grateful for the scholars who continue to place their trust in this journal and for the reviewers whose principled and thoughtful assessments make that trust worthwhile. As we look ahead, I encourage all members of our academic community to stay committed to meaningful inquiry, to approach their work with both curiosity and discipline, and to allow their research to grow at the pace of understanding rather than the pace of pressure. If Omniscient can help foster such a culture, it will not only publish research but also strengthen the spirit that sustains it.

**(Prof. K. P. Singh)**

# OMNISCIENT

## (An International Multidisciplinary Peer-Reviewed Journal)

## Content

# A Comparative Analysis of SAFAL and NAS: Understanding their Roles in Indian Educational Assessment

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## Abstract

Evaluation is a central component in the development and practice of education policy, as well as the improvement of the student learning outcome. In India two large frameworks called SAFAL (Structured Assessment to Analyse Learning) and NAS (National Achievement Survey) which helps to assess competencies of students and learning outcomes at the system level. As part of the National Education Policy 2020 (NEP 2020), the CBSE initiated the SAFAL that targets competency-based evaluation in Grades 3, 5, and 8 at the school level. NAS which is now operational as PARAKH Rashtriya Sarvekshan is an extensive survey executed by NCERT by means of measuring the overall performance of the education structure both nationally and state wise. The following paper provides the comparative analysis of SAFAL and NAS in terms of its goals, approaches, area of focus, and achievements. The analysis identifies the correlation of the frameworks with the vision of NEP 2020 due to the betterment of the learning outcomes and shares the implantation concerns. The results show that although SAFAL is used to facilitate continuous evaluation and differentiated learning enhancements, NAS is used to provide important evidence needed in the formulation of a policy and the transformation of a school. The conclusion of the paper can be summarized as the suggestion to balance both of the said frameworks to augment student learning and educational planning in India.

KEYWORDS: SAFAL, NAS, Competency-Based Assessment, NEP 2020, Educational Evaluation

## 1. INTRODUCTION

Assessment is an institution of the process of education, and as a system, it is defined as a method used to tracking, quantifying and improving student knowledge levels and the overall work of the educational system as a unit. According to modern day education, assessment is not just a kind of tool to grade or certify but rather a method based on evidence to enhance pedagogy, adjusting the curricula to needed abilities, and decision making in terms of policies.

An effective evaluation frame enables stakeholders such as teachers, policy makers and curriculum developers to detect areas of learning areas, monitor what is being achieved over time and how the interventions can address the gaps depending on the need at hand.

Large scale and school-level testing has gained momentum especially in the aftermath of the National Education Policy (NEP) 2020 which proposes the replacement of the rote learning with competency based holistic and constant evaluation. Two noticeable efforts that fuse these values are SAFAL (Structured Assessment for Analyzing Learning) and NAS (National Achievement Survey). Although both are intended to measure learning outcomes, they have vast difference in their scope, method, and use of data.

SAFAL, a quasi-shorter version of NEP 2020's vision, is a competency-based assessment tool set in Grade 3, and Grade 5 and Grade 8 of schools associated with CBSE. In contrast to high stakes tests, SAFAL focuses on conceptual advances, application of knowledge, and problem-solving skills rather than on rote memory. This prescriptive nature is like DNA that provides constant feedback that educators can use to optimize their teaching campaigns and pivot on learning deficits as they occur. Safal also pursues the objectives of the NIPUN Bharat mission that aims to access ensuring the skills of basic literacy and numeracy by Grade 3 by focusing on Foundational literacy and numeracy (FLN).

Conversely, NAS, administered and assessed by the National Council of Educational Research and Training (NCERT) has historically been a large-scale, sample-based, summative assessment in Grade 3, 5, 8 and 10. It does assess learning outcomes nationally, at the state level, in the district, and at the school-system level. NAS also offers macro-level data of quality, equity and effectiveness of education to policy formulators hence directing changes in curriculum, capacity-building in the educational teaching staff and allocation of resources. In comparison with the SAFAL, which provides school-specific diagnostic information, NAS comes up with systemic findings that assist in formulating systemic educational approaches.

Remarkably, as per the recommendation of NEP 2020 of developing a National Assessment Centre, the NAS has now been renamed and made refurbished as PARAKH (Performance Assessment, Review and Analysis of Knowledge towards Holistic Development) Rashtriya Sarvekshan (PRS). This revised framework, also carried out in 2024, had objectives of enhancing coherence, transparency and competency alignment to big-scale assessments in India. The findings published in 2025 delivered a system-wide picture of learning trends among students

and demonstrated geographical differences and strengths and weaknesses of the systems. Such a transformation constitutes a move to position PARAKH not just as an examination exercise, but as a hub of measurement around which evidence-based educational policy making in the nation should take place.

Although SAFAL and PARAKH Rashtriya Sarvekshan augment the general goals of NEP 2020, both differ in terms of their design philosophies, implementation process and their impacts. A micro-level of school-based management SAFAL that enhances individual student learning and a macro-level of monitoring Rashtriya Sarvekshan of PARAKH are the guides that can clarify national and state-level policy changes informed by national questions. This is because their complementary importance allows us to develop an equal and integrated assessment ecosystem that is an initiator of education change.

This paper sets about to make a comparatively critical analysis of SAFAL and PRARKH Rashtriya Sarvekshan (or previously NAS) and the factors of goals, coverage, approach, focus areas, and its compatibility with NEP 2020. It also discusses the strengths, the constraints and the difficulty of implementing each and also offers judgments on how both tools can be integrated together. We hope that by examining the manner in which these frameworks can act in synergy, this study can assist educators, administrators and policymakers in the effort to improve the output of learning and to promote learning reform in India based on evidence-based actions.

## 2. REVIEW OF RELATED LITERATURE

The related literature review is done in a way that it has a rooted view of the context, development and implication of SAFAL and PARAKH Rashtriya Sarvekshan in India pertaining to the educational assessment environment. The themes involve reforms to assessment under NEP 2020, competency-based evaluation and its importance, large scale assessments in India, school based formative assessment and its challenges and opportunities of implementation.

### 2.1 Assessment Reforms under NEP 2020

This paradigm shift in the education system of India has been proposed by the National Education Policy 2020 that calls on shifting the education system of India towards the idea of abandoning the rote memorization and shifting towards competency-based, holistic, and continuous assessment (National Education Policy 2020, 2020). This form of teaching and assessment uses low stakes, formative assessment rather than high-stakes exam- focused learning as a strategy to increase both conceptual understanding and learning of knowledge application.

The formation of the National Assessment Centre - PARAKH under NEP 2020 can be seen as a standardization and a bench setter to establish quality and compatibility of assessment across the country. Rao and Gupta (2023) observe that such reforms frame assessments as a part of the learning process but not at the end of a process to evaluate the learners.

## 2.2 Competency-Based Evaluation and Its Significance

Competency-based assessments evaluate the competence of a learner in the ability to apply his/her knowledge, think critically, and solve real life situations. NCERT (2022) states that this transition is crucial to cultivating 21 st century skills and in fulfilling the targets of Foundational Literacy and Numeracy (FLN) within the NIPUN Bharat Mission. CBSE (2021) has borrowed this philosophy by measuring the learning outputs of its students in Grades 3, 5, and 8 in conceptual understanding, application abilities, and problem-solving skills providing diagnostic information on which to shape teaching methods.

## 2.3 Large-Scale Assessments in India

The National Achievement Survey (NAS) which is conducted by NCERT has traditionally offered macro-level data in terms of learning outcomes among students at subject and region level (Ministry of Education, 2021). NAS was restructured and renamed as PARAKH Rashtriya Sarvekshan in 2024 and the results announced in 2025. This new design (revised framework) gained intensity in the competency alignment, sampling procedures and reporting processes that would effectively serve as national benchmarking tool. Such information is essential in guiding education course of action, professional development actions, and provision of education resources across the board (NCERT, 2022).

## 2.4 School-Based Formative Assessments

It has been concluded that formative assessment that is part of everyday classroom activities leads to great results when used adequately. SAFAL is a diagnostic mechanism functioning at the school level that assists teachers in recognizing gaps in learning and devising specific interventions (CBSE, 2021). The popular work by Black and Wiliam (1998, as published by NCERT publications) supports the idea that formative assessment questions have the capability of offering constructive and timely feedback that can have significant impacts on student achievements.

**2.5 Challenges and Opportunities in Implementation**

Although there is potential, SAFAL and PARAKH also experience the lack of teacher preparation, inconsistency in assessment meaning, and the infrastructural limitation, particularly in the rural and under-resourced schools (NCERT, 2022; Rao & Gupta, 2023). Some stakeholders also have the tendency to consider competency-based results in the traditional marks-based format, which can hamper its objective. Still, there are chances in the usage of digital tools, the strengthening of teacher potential through specific training, and the synchronization of institutional efforts by CBSE, NCERT, SCERTs, and DIETs to be sure of its uniform and social inclusion (CBSE, 2021; Ministry of Education, 2021).

## 3. METHODOLOGY

The research design used in this study is qualitative, descriptive, and analytical that attempts the comparison of the aims, framework, execution, and result of the Structured Assessment for Analysing Learning (SAFAL) and NATS now transformed into PARAKH Rashtriya Sarvekshan. The study will use secondary sources of data, wherein various official policy documents have been used, and these are the National Education Policy (NEP) 2020, the SAFAL Assessment Framework which was issued by CBSE and the NAS 2021 National Report which was published by NCERT. Other sources are press releases, updates and reports of the 2024 edition of PARAKH Rashtriya Sarvekshan and its findings announced in 2025, as well as peer-reviewed journals articles and policy briefs on large-scale and school-based evaluation in India.

Data were collected through systematic review of governmental actions in the case of government portals, academic database, and valid scholarly research findings to ascertain extreme relevance and legitimacy. The thematic analysis approach was considered to analyse the information obtained with the main deals on the parameters that included purpose, scope, methodology, focus of assessment, type of assessment and data utilization. Through this comparative framework, similarities, differences, strengths, and limitations of SAFAL and PARAKH could be identified, and how they match the objective of NEP 2020 could be found out. Other issues studied involved the challenges of implementation, trends emerging, and inherent areas where the two frameworks can be used to supplement one another in improving the quality of education. The constrained range of this study is the publicly available data and since the PARAKH Rashtriya Sarvekshan is an initiative recently implemented, conclusions

about the long-term effects are taken according to the first cycle, that of 2024, and the outcome of the initiative released in 2025.

## 4. COMPARATIVE ANALYSIS OF SAFAL AND NAS

The extensive comparison of SAFAL and NAS in consideration of the main parameters which include the purpose, implementation, scope, methodology, focus, the type of assessment performed and the way of data used makes sense in terms of the specific functions they play within the Indian education system.
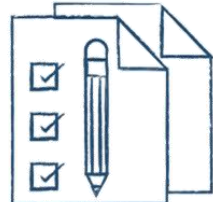
## COMPARATIVE ANALYSIS OF SAFAL AND NAS

| Aspect | SAFAL | NAS |
|---|---|---|
| Purpose | Diagnostic | Evaluative |
| Implementation | School-based | National |
| Scope | Internal | Systemic |
| Methodology | Competency | Survey |
| Focus | FLN | Subjects |
| Assessment Type | Formative | Summative |
| Use of Data | Instructional | Policy |

**Figure 1**

### 4.1. Purpose

In the context of the National Education Policy 2020, the CBSE has launched SAFAL a competency-based assessment which evaluated conceptual understanding, skill competencies and critical thinking in the 3rd, 5th and 8th Grades. It is mainly to track school-level learner improvement and to give the teacher advice on how to perfect teaching methods.

Comparatively, National Achievement Survey (NAS) by NCERT is a large-scale national survey that is supposed to evaluate the effectiveness of the entire education system in Grades 3rd, 5th, 8th, and 10th. Held every third year at both state and national levels organised by NCERT in conjunction with state education departments, NAS is summative in approach moving toward the

sample and it yields macro-level information to the curricular-reform policy and teacher professional-development decisions.

## 4.2. Implementation procedures

SAFAL is used at school level. Because of the formative orientation of assessment, it is conducted once a year at institutions affiliated to CBSE and such institutions exercise discretion when they decided how the test should be scheduled and administered so that it correlates with their curriculum goals.

In the case of NAS in comparison, its system of functioning is on 4 levels, national, state, district, and school thereby covering the state board, CBSE and other educational systems throughout the states and Union Territories. Also, its summative structure requires the use of a representative sample, which is achieved by random stratified sampling procedure and periodically administered.

## 4.3. The Spectrum of the assessments

SAFAL focuses on CBSE schools and can be utilized as an internal assessment device where teachers and students can spot deficiencies in learning and perfect their classroom activity.

Compared to that, NAS is more inclusive instead. It is aimed at estimating work of the whole educational system and not just the work of a particular institution.

## 4.4. Methodology

SAFAL, which is a competency-based assessment platform, evaluates students based on learning outcomes, critical thinking skills and application-based skills rather than rote forms of pedagogy. Its questions in tests are developed to coincide with the National Curriculum Framework (NCF) and NEP 2020 guidelines.

In NAS, the large-scale survey-based methodology on the other hand uses scientific sampling stage where students and schools which are considered samples are selected. It later measures the learners based on pre-determined indicators and reports at the national, state and district level track trends over time.

## 4.5. Focus of Assessment

In regard to the area of assessment focus, SAFAL focuses on foundational literacy and numeracy (FLN) hence contributing to the goal outlined in NEP 2020 by enhancing learning outcomes in early grades. This will help learners develop conceptual and solving skills as it has been done with continuous student assessment.

In place of this, NAS is administered in core classes- Mathematics, Science, Social Science and Language across the grade's levels. The primary purpose is the evaluation of the effectiveness of the educational system as such, instead of tracking the performance of a person.

## 4.6. Assessment Type

SAFAL is regarded as being a low-stakes an early formative selection: it is not supposed to be graded or ranked and rather has diagnostic and intervening aspects. NAS, in turn, is a high-stakes, summative assessment procedure founded on a survey that provides statistical information concerning the student learning on a large scale. The individual scores are not reported, but the combination of data is used in policy and resource allocation.

## 4.7. Use of Data

The SAFAL-derived data have been used by teachers, school administrators and education planners to perfect pedagogical approaches, augment curriculum delivery and offer focussed learning assistance. The general aim of doing this is to improve the performance of individual learners and the performance of the entire school.

In the case of NAS, government agencies, policy analysts, and researchers are the most likely consumers of the collected data as they are to analyse education trends in national and state populations, detect inequality in learning outcomes, and allocate funds appropriately. In such a manner, the tool can help in the community of policy building, process and capacity building of educators and in determining curriculum change.

## 5. ALIGNMENT OF SAFAL AND NAS WITH NEP 2020

The National Education Policy (NEP) 2020 presents the vision of a student-centered competency-based and holistic education system that does not revolve in memorizing and high stakes examination. SAFAL and NAS are associated with NEP 2020, in various ways and, bypass itself, being part of its aims of enhancing the learning outcomes, the reform of assessment and reforms to policymaking that is based on evidence.

## Alignment of SAFAL and NAS with NEP 2020

| ASPECT | SAFAL | NAS |
|---|---|---|
| Assessment Type | Formative, low-stakes, competency-based | Summative, sample-based, system-level |
| Focus Area | Individual student learning & FLN (Grades 3, 5, 8) | Macro-level learning outcomes & FLN |
| NEP Alignment | Continuous, holistic assessment; student-centric | System-wide progress; policy feedback |
| Use of Data | Real-time school-level insights for pedagogy improvement | State/National data for policy planning |
| Skill Focus | Conceptual clarity, critical thinking, creativity | Subject-wise achievement & competency mapping |
| FLN | Supports NIPUN Bharat; promotes FLN, reduces exam stress | Tracks NEP reforms; supports equity and learning improvement |
| Outcome Utility | Guides teachers for personalized interventions | Helps policymakers evaluate and reform the education system |

**Figure 2**

### 5.1. Shift to Competency-Based Assessment

SAFAL and the NAS are two other tools that are not interchangeable but complementary to follow the progress in competency-based education through the National Education policy 2020. SAFAL is conducted in schools by measuring the ability of learners to apply, reason and solution real world problems; moreover, it is also concerned with creating foundation literacy and numeracy (FLN) which are concrete conceptual stems at first level of education. NAS, in its turn, also represents a snapshot of such competencies used on a national level, by comparing results of the learning based on a representative sample of students that can provide policymakers with a rough understanding of the success of the process in which the system is being transformed to be based on competency-focused practice.

### 5.2. Emphasis on Formative and Continuous Assessment

The two tools are formative-assessment oriented. Supporting low-stakes schools run by classroom teachers, the monitored performance of the individual learner would be followed

through and specific interventions provided, which fits the recommendations of NEP 2020 that high-stakes board examinations be replaced by more regular and holistic assessments. NAS is meant to be administered periodically but much like the other is more overtly summative, although because it tracks national and state level trends provides decision makers with evidence as to whether the incremental reforms to education are having appreciable results.

## 5.3. Data-Driven Decision-Making for Education Policy

Regarding data usage, SAFAL provides fine-grained, school-specific data to both teachers and administrators that will enable them to distinguish and modify their instructional activities based on live student performance. NAS, in turn, gathers macro-level evidence about literacy and numeracy and, therefore, influences the strategic choices when it comes to curriculum design, professional development of teachers, and resources allocations.

## 5.4. Focus on Foundational Literacy and Numeracy (FLN)

Namely, SAFAL monitors FLN at Grades 3, 5, and 8 and hence can help to pursue the NIPUN Bharat Mission, an essential part of NEP 2020. By establishing the mastery over fundamental language and arithmetical abilities, SAFAL helps the learners to receive the precondition to later intellectual growth throughout their lives. Although working at a larger scale, NAS provides a comparative data at the state, district and social levels of data, which help to evaluate whether goals set nationally in literacy and numeracy are achieved.

## 5.5. Holistic Development and Multidisciplinary Learning

SAFAL is a tool that promotes comprehensive assessment by evaluating the work of students in areas beyond the area of purely textual knowledge, which is the problem-solving, critical thinking, and creativity, therefore reaching the goal of the National Education Policy 2020 of raising all-rounder learners.

NAS, however, despite being subject-centred in the majority of aspects, provides data that is relevant in developing holistic-education policy as such that schools will implement the directive in the NEP 2020 of giving multidisciplinary instruction and curtailing curricular overloading.

## 5.6. Reforming Examination and Assessment Systems

SAFAL supports the suggestion made by NEP 2020 to reduce reliance on final examinations and to introduce continuous, competency-based assessment with the focus on skill development. The program aims at reducing the examination stress and idea-based learning also.

NAS ensures effective monitoring of the implementation of the assessment-reform process, which ensures that schools are moving out of the rote-based assessment process towards the competency-based learning in line with NEP 2020.

## 6. CHALLENGES AND LIMITATIONS OF SAFAL AND NAS

While SAFAL and NAS play crucial roles in India's education system, they also face several challenges and limitations that impact their effectiveness. These challenges arise from implementation issues, data interpretation, assessment design, and systemic constraints.

### 6.1. Implementation Challenges

Regarding relative academic rigour, it is necessary to point out that despite the fact that SAFAL is currently slated to be applied in all CBSE schools, the nonhomogeneous nature of its implementation makes the programme vulnerable to different interpretations, thus introducing fluctuation in the assessment quality. Comparatively, the NAS uses a mass sampling based approach to derive national benchmarking data but the arising indicators do not necessarily give precise data about the level of learning of the entire body of students. In addition, the logistical issue of organizing surveys in different geographic areas, as well as the problem of managing consistency in surveys, are the major implementation obstacles.

### 6.2. Teacher Training and Awareness

In terms of pedagogical implication, SAFAL and NAS are ambiguous with regards to the quality of the teacher preparation and awareness. SAFAL presupposes that educators have skills of creating and adapting competency-based assessment; however, the lack of professional development may motivate teachers to switch back to rote-learning patterns, which is contrary to the objectives of the programme. On the other hand, since the administration of the NAS, a test-like assessment, is held externally, it is common that the validity of survey results is not understood by teachers and hence may hinder its use in iterating classroom practice.

### 6.3. Overemphasis on Data Without Actionable Insights

Excessive can also be found involving the two programmes through the aspect of using data to improve. Despite the indicators of performance at school level provided by SAFAL, the lack of systematic measures to transform knowledge gained into data-informed decision-making can work impedimentally in terms of significant improvement of instructional strategies. In the same manner, albeit NAS delivers the macro-level knowledge, the subsequent level of detail does not enable the school administrators to apply it directly in the classroom curriculum. The delays that

are observed in the action of the policy, compared to the time that it took to collect the data can also be a problem in translating the results of the surveys into action.

## 6.4. Assessment Design and Learning Context

Last but not least, the two frameworks are characterized by unique issues regarding the correspondence to the pedagogy in a classroom setting. SAFAL shows more emphasis on competency-based assessment but in the event that the mode of instruction at schools does not match this type, then the learners might demonstrate difficulty in its proficiency. NAS conversely is founded by a representative sample that could neglect the heterogeneous level of learning that could exist between socio-economic strata, linguistic communities and schooling system and hence its representativeness.

## 6.5. Limited Scope for Individualized Learning

Traditional models of school accountability, SAFAL and NAS, are used in particular ways in the field of education. SAFAL, whose intended use was to keep track of the performance of individual students, is not able to provide a personalized guidance to learners nor is it able to give recommendations to learners, thus reducing the effectiveness with which learning institutions are able to use assessment measures to provide specific instructional strategies to the student. On the other hand, the results of NAS are aggregate scales of assessment that assist in policymaking on a national or state level, but its outcomes can hardly be translated into practical knowledge, which can be applied to a classroom setting in targeted pupils.

## 6.6. Resistance to Change in Assessment Culture

Moreover, the two systems are faced by an existing cultural resistance to change. The move to a competency-based assessment as suggested by SAFAL has been quite controversial, with educators, parents, and administrators alike viewing SAFAL outcomes, in a more marks-based perspective, causing the fear of not performing well in marks. Similarly, the consequences generated by NAS require long-term policy capture of many years, but administrative inaction and deficiency of information among educators often hinder the application of reforms capable of exploiting its analytical capabilities.

## 6.7. Technological and Infrastructure Constraints

Infrastructural and technological constraints are being faced within the two models. Seven percent of they are not sufficiently dependent on either type of location in order to provide digital assessment facilities, sufficiently trained teachers, and materials to manage routine digital

assessment instruments' utilization and hence providing SAFAL even depicts a complex set of issues. NAS similarly needs an effective coordination mechanism between NCERT and concerned states of education and school levels and the asymmetry of the various levels of digital infrastructure, professional development, logistic capacities paralyze data collection, data processing, and sharing.

## 7. RECOMMENDATIONS

Some of the recommendations that are required to facilitate the effectiveness of SAFAL and NAS in the realization of the goals of NEP 2020 are as follows. Such recommendations aim at teacher preparation reserialisation, the implementation schemes, improvement of data utilization, betterment of the infrastructure level, and policy aspect overall transformation thus entrenching to more healthy and meaningful evaluation system.

Among the key ideas proposed concerns the training and capacity building of the teachers. Considerable workshops, systematically arranged professional development seminars will be required to the effect that teachers would become familiar with the standards of the competency-based assessment and their proper use. Moreover, the introduction of digital instructional modules can give the teachers assessment techniques, and the competence of data-based decision making. Developing teacher-sensitive recommendations of how to interpret NAS outcomes effectively will enable teachers to be more willing to convert the insight so gained during the assessment into classroom behaviours that will later be reflected into observable improvements in learning outcomes.

The element of enhancing implementation plans of both SAFAL and NAS is the second factor that gives rise to a critical recommendation. Consistency in assessment procedures by possessing a prototype layout of SAFAL in CBSE schools and being subjected to efficient monitoring and supervising frameworks need to be in place. With NAS, on must further extend the logistic coordination to eliminate the problem of sampling bias and be in a position to collect such a large amount of information. Improved integration among state governments, CBSE and NCERT will also contribute towards harmonizing school-based testing with one done by NAS, which improves the consistency of the process of evaluation.

Better use of data should be employed to maximize the effect of these instruments. Introduction of real-time dashboards will give schools an opportunity to study SAFAL results and introduce tailored learning interventions. Moreover, the recommendations made by Nathan ought to be

immediately adopted at the level of policy making to inform curriculum decision making and professional development of teachers. Distribution of action such as district-wise and school-specific reports with actionable recommendations will help educators in translating the data into the good teaching strategy which finally reflects the student learning outcomes.

In an effort to make assessment practices compatible with the National Education Policy 2020 (NEP 2020), teachers have to focus more on critical thinking, problem-solving, and application-based learning as opposed to rote learning. In such a context, the continuous-assessment models would have a positive impact on the Speedy Assessment of Basic Skills in Learning (SAFAL) program in terms of promoting its generalised scoring instead of focusing on using the high stakes examinations which are periodically taken. The National Achievement Survey (NAS), in its turn, should be expanded beyond basic literacy and numeracy, and admit multidisciplinary one, socio-emotional skills and competencies of the twentieth century, to render the assessment mechanism more multifunctional in its purpose to measure general student performance.

The implementation of technology will also be one of the fundamental interventions to change both SAFAL and NAS to become less sensitive and more scalable. On AI-based assessment tools, this kind of real-time feedback would be done automatically and help teachers along with students more quickly recognize discrepancies in performance. The implementation of digital assessment platforms in rural areas and schools that underperform would therefore play a major role in closing the digital divide so that all high-quality assessments would be available to all students. Simultaneously, machine-learning models and big-data analytics may be applied to monitor the performance patterns across the curriculum so that specific interventions could be implemented where they are necessary.

In addition, more emphasis on school level and policy level interventions is necessary to lead to the actual taking of results of assessment into education. SAFAL data, in turn, should be used by schools to develop remedial programme, peer-learning programme and differentiated programme as per the needs of individual students. Policy level on the policy level, it will be enough to create a feedback loop that will enable the responsive strategy to be deployed quickly between the results of the NAS and the decisions on education reform. Improving performance among parents and other members of the community is also crucial to the process of assessment in that an inclusive participation of the latter will encourage the process of studying together with the students with considerable intensity levels of competency-based education.

Indian education system plays vital roles in large-scale assessment programs, like SAFAL and NAS, but this depends on the proper provision of infrastructure and access. This need is especially acute in terms of the rural and resource-limited schools. Consequently, they should receive long term and equitable funding sources as well as have sufficient provision of technological resources to make the implementation of SAFAL at these institutions worthwhile in a responsible manner.

The area of upgrading digital infrastructure, mostly through supply of functional computers, quality internet connection and special assessment software, is a pivotal prerequisite of technology-based testing. Where this infrastructure cannot be reached, contingent strategies, especially, the use of competency-based pen-and-paper testing supplemented with an explicit evaluation rubric, should be systematically used.

This will help in aligning SAFAL to the large-scale evaluation tools because of the establishment of a single national assessment framework. Formative school-based assessment combined with macro-scale summative surveys has a coherent representation of what the student has learned both on an individual level and the system itself. Achieving this goal requires greater collaboration between CBSE, SCERTs, DIETs and NCERT to standardise assessment formulation and administration to a variety of education boards and institutions.

All these proposals make it possible to conclude that both SAFAL and NAS are indeed a tool that can be re-tuned in order to be more useful in improving instruction not only on local but on the level of forming policy and acting in pedagogical practice. The intentional incorporation of teacher professionals, incremental technology integration, procedural transformation guided by evidence and the aligning with NEP 2020 will imply that the said structures will contribute value to the new education panorama of India.

## 8. CONCLUSION

As the comparative case study SAFAL and NAS reshaped into PARAKH Rashtriya Sarvekshan, it is clear that, besides a shared goal of enhancing learning outcomes in India, both assessments frameworks work on radically different planes and address complementary issues. As a school-based, competence-driven, formative measure, SAFAL enables teachers to distinguish personal learning shortcomings, encourage conceptual wisdom, and help build talents among pre-schooled and middle years students. Its priorities in relation to Foundational Literacy and Numeracy

(FLN) are quite similar to nep 2020 vision and contribute to constant improvement of the situation at the classroom level.

Conversely, NAS converted into PARAKH Rashtriya Sarvekshan in 2024 is more of a macro-level, sampling based large scale survey to produce strong, comparative student learning data at the national, state, and district level. The 2025 output of PARAKH gave policymakers of the necessary insights on the localized disparity, subject-specific skills, and equity of education, enabling specific interventions to be made, and curriculum changes amounting to reform and teachers' professional development programmes. This rebranding and reorganization have taken NAS to a periodical survey rather than a centralized national benchmarking mechanism administered by PARAKH, to ensure uniformity in competency-based learning and standard-setting throughout the education boards.

As pointed out in the analysis, synergy is the key driver to the realization of NEP 2020 vision of a holistic, equitable, competency-based education system in terms of SAFAL and PARAKH Rashtriya Sarvekshan. SAFAL will help our micro level instruction needs by offering diagnostic feedback that may directly impact practice at the classroom level, whereas PARAKH will help us deliver macro level policy intelligence able to drive systemic change and resource distribution. Nevertheless, the two frameworks rely on the readiness of teachers, the use of data on time, the sufficiency of infrastructures, and the eagerness of the stakeholders to adopt transition towards competency-based education as opposed to rote learning.

India should have a loop of annual and ongoing assessment so that the assessment procedures of schools operate more convincingly and purposefully on the national level. Granular data at SAFAL, and aggregated results at PARAKH should then be used to design specific intervention in schools, and policy priorities as well as capacity-building actions on a large scale. In addition, deployment of technological advancements, development of digital infrastructure and strengthening of cooperation between CBSE, NCERT, SCERTs, and DIETs will play an important role in unifying the quality and accessibility of assessment throughout the various regions.

Finally, the education in India cannot escape the future examination on the basis of selecting between SAFAL and PARAKH but rather by balancing those advantages. Such a dual approach integrating the formative and learner-centered focus of SAFAL with a system-wide oversight of the role of PARAKH will ensure that data-filled insights find effect at the large-scale education

system level. When applied successfully, this combined model is capable of turning assessments into both an evaluation exercise and a weapon of equity, excellence and lifelong learning in the Indian education environment.

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# Specific Challenges Faced by Girls with Autism Spectrum Disorder A Case Study

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**Abstract**

Autistic girls face complex and diverse challenges. The present study aimed to study the specific challenges faced by girls with autism spectrum disorder. The investigator had used the case study method, for which a seventeen-year-old autistic girl, along with her mother, was purposely selected for the data collection. Results based on the data collection had listed various challenges that this autistic girl has been going through.

Keywords: Autism**,** Specific challenges, Autistic girl, Menstrual Cycle, Discrimination

**Introduction**

I was attached to a special school for data collection purposes for my PhD thesis when this beautiful little girl, named Allen, an autistic girl, intrigued my interest. She had a habit of eating salt, a bowl full of salt. She would cry or shout at the top of her lungs whenever that bowl was taken away. Staff at the school were instructed to hide bottles/packets of salt, which were used in the small kitchen of the school. Later, I observed that the same girl had some sort of itching issues in her vaginal area. I heard once a lady staff member saying that either Allen eats salt all day, or she keeps itching her private parts (which bruises her vagina). I don't know why, but after hearing this, I realised that there is some connection between itching with the salt. After searching for many websites and research papers, I understood that some autistic children may eat excessive amounts of salt due to sensory sensitivities, preference for intense flavours, or as a way to self-soothe or cope with stress, which in turn causes hypernatremia. "Hypernatremia" is a condition where there is too much sodium in the blood, which can affect urination patterns and potentially cause itching in the vagina. I kept on thinking about the pain and uneasiness this little autistic girl, Allen, must be bearing/holding due to the condition. Though, as per the data, autism spectrum disorder is more prevalent in boys than girls (Wilson et al., 2016), the ratio is 4:1(Baron-Cohen et al., 2014). But after coming across Allen, the need to address specific challenges faced by autistic girls sparked in my brain.

**Autism Spectrum Disorder**

Autism is a developmental disability. Individuals with ASD often have difficulties with social communication and interaction, and restricted or repetitive behaviours or interests. It creates a miscellaneous group of conditions and symptoms related to the progress of the brain. About 1 in 100 (WHO,2023) children have autism. Individuals with autism often have comorbid conditions (WHO, 2023), including epilepsy, depression, hyperthermia, anxiety, attention deficit hyperactivity disorder, difficulty in sleeping, and are prone to self-injury. The comorbidity makes their life way too challenging, as many times in the presence of one condition, the symptoms of another condition get camouflaged.

**Autism in Girls**

Females are more likely to display concealing or masking (Schuck et al., 2019) the symptoms of autism than boys, often leading to delayed diagnosis. Sex differences have been reported in autistic traits and systemising (male advantage), and empathising (female advantage) among typically developing individuals (Baron-Cohen et al., 2014). While boys may display more apparent behavioural challenges, girls are more likely to internalise their symptoms, experiencing anxiety, depression, and social difficulties that may be unnoticed. In the dearth of timely identification, detection and intervention, the challenges faced by girls are explicitly specific. They are specific in all sorts of dimensions, viz, mental, physical, physiological, social, and anatomical.

**Significance of the Study**

The present study is central and decisive because this study will help in understanding the exclusive challenges a girl with autism must be living with, also the study will assist in understanding the necessity of support systems. This research is especially significant because autistic females are often underdiagnosed or misdiagnosed, leading to a lack of appropriate support and increased vulnerability to mental health issues, physical health issues, abuse, mishandling, exploitation and other challenges.

**Objective of the Study**

1. To study the specific challenges faced by girls with autism spectrum disorder.
2. To provide suggestions for overcoming the challenges faced by girls with autism spectrum disorder.

**Delimitation**

1. Only a 17-year-old girl with ASD was selected for the study.

2. A girl with ASD who was already labelled and studying in a special school in Lucknow city was selected for the study.

3. A girl with level-1 autism was selected for the study.

4. Only 01 parent, the mothers of the girl, was selected for the study.

**Methodology**

As a case study, this is a preliminary investigation of a phenomenon over which we had little control (Yin, 2017). According to Miles et al. (2019), a case is "a phenomenon of some sort occurring in a bounded context". As the researcher seeks an exploration of specific challenges faced by girls with ASD, the Case study method was used in the study. Furthermore, this is an exploratory case study given that it was not intended to test a particular hypothesis (Yin, 2017). As noted by Hancock and Algozzine (2011), exploratory case studies serve as a prelude for more expansive investigations that might seek to work with a concept in a more in-depth manner. Given the small sample size, our findings are not generalizable.

**Population**

All the girls who are labelled as autistic make up the population of the present study.

**Sample**

Keeping in mind the onset of puberty, menstrual cycle and various bodily changes (so that specific challenges can be studied), a seventeen-year-old autistic girl was selected for the present case study. As the girls remain close to their mother and generally mothers look after the child, so mother of this girl was also selected for the study.

**Sampling**

The Purposive sampling technique was employed by the investigator to select the sample. Firstly, a list of all the autistic girls studying in the Rainbow Society for autism was made by the researcher. Secondly, out of the above list, the investigator has purposely selected a 17-year-old girl who was labelled as level-1 autistic.

**Tools**

As the investigator has to collect the data, keeping in mind the specificity of the challenges faced by autistic girls. There weren't any standardised tools available, so investigators had developed an interview schedule for collecting data from the mothers of the autistic girl.

**Theoretical Framework**

The present case study is framed around the "Social Role Theory". This theory impacts the course of socialisation and personality development through the person's input in increasingly diverse and intricate social roles. Social role theory claims that gender differences in behaviour

stem from the division of labour in society and the parts that men and women inhabit. It assumes that societal roles, shaped by biological factors and then reinforced by cultural norms and expectations, influence how individuals perceive themselves and others, leading to distinct gender roles and stereotypes. The investigator has noted that the idea of specific challenges faced by women in societal settings is not a new one; it has been documented throughout history.

**Context**

The case study was carried out at a private special school for autistic children approved by RCI. Though the school is specifically for autistic children, children with other types of disabilities are also enrolled there. The total of this school is 108, out of which 37 are autistic children. It was found that out of these 37 autistic children, only 07 were girls, as the prevalence of autism is higher in boys. Out of these 07 autistic girls, only 02 girls were teenagers, i.e. puberty had hit. Out of these two girls, only one parent permitted the collection of the data.

The school is run by a lady, the principal of the school. The staff of the school is predominantly female, including teachers and Aya Didi. A few male therapists were also working there. The school runs its school bus; the driver and conductor are male.

**Participant**

The participant is a seventeen-year-old autistic girl who lives with her mother, brother and grandmother. She had lost her father a few years back. As per her mother, she was born normal- a chirpy little girl. She danced on her first birthday, and everything was going well. Before her second birthday, she started showing the symptoms of autism. She attends the school regularly, along with the therapies being provided at the school itself. A cafe is being run by this school, and the participant is among the few special children of this school who are being trained to run this cafe.

**Data Collection**

A total of eleven visits were carried out by the investigator, with seven at school and four at the cafe run by the school. Visits were typically on Mondays and Wednesdays, though one of the visits was on other days of the week due to events at the school, due to which the investigator was unable to meet the mother of the child or observe the child. The researcher has chosen Monday and Wednesday because, as per the timetable, the child had to undergo the therapy sessions as well, along with the regular classes. The mother had permitted the investigator to video record the interview session. In the entire eleven-day visit, interview sessions lasted around two hours every day. There was not a single problem encountered by the investigator

while interviewing the mother of the participant, as she was regularly accompanying her daughter to school, and remained sitting outside the classroom till the school day was over. Besides, this mother was very genial with the investigator. The investigator also tracked/observed the frequency of certain behaviours exhibited by the autistic girl in the school and cafe.

**Limitations**

Case studies, predominantly those that are exploratory and utilise within-case investigation, are not generalizable as they concentrate in-depth on one particular case to thoroughly comprehend some facet of that case. Added time observing the participant and leading the study over an extensive period of time would have given a more vigorous set of data. The investigator could not get permission to interview the brother and grandmother of the autistic girl. Also, the investigator could not observe the child at her home because of a personal reason, as quoted by the mother.

**Data Analysis**

Miles et al.'s (2019) method on qualitative data analysis is followed in the present study. The investigator had analysed in two phases of coding on the interviews. The first cycle of coding employed numerous kinds of coding, including descriptive, in vivo, and emotion coding. The purpose of the first cycle of coding was to précis the obtained data. The second cycle of coding helped to recognise outlines in those codes. Codes were then assembled into groups or themes. Later investigator marked down the themes. Following the use of jottings of marked themes, analytic memoing was designed, which assisted in "synthesize (descriptive summaries of data) into advanced level analytic meanings".  Analytical memos spread and join numerous data with theory and the researcher's observations.

To formalise and organise the answers given by the mother of the autistic girl and observations made by the investigator, the investigator had produced assertions and propositions (based on both sources of data). These statements allowed the investigator to look at the findings broadly and better determine the entire picture, based on the available data.

**Results, Findings and Discussion**

Being a woman is beautiful. But it can be challenging being a woman at times. It could be more challenging when a womanhood is co-morbid with autism. Based on the data collected from interviewing the mother of an autistic girl and observation done by the investigator, the following findings are analysed by the investigator-

## I) Menstrual Cycle Related challenges:

The inception of menses (menarche) is a significant—and often challenging (Burrows and Johnson,2005)—transition in any woman's life. This is especially the case for developmentally-disabled women, who may experience menarche and menstruation contrarily—and more undesirably—related to non-disabled women (Ditchfield and Burns, 2004; Rodgers and Lipscombe, 2005). While there are no significant differences in the age of menarche between autistic girls and girls with other developmental conditions (Burke et al., 2010), there are several reports (including case studies) of marked changes linked to menarche and menstruation in autistic girls and women (the majority with additional intellectual disabilities), including cyclical self-injurious behaviours (Lee, 2004), mood symptoms and emotional dysregulation (Burke et al.,2010; Hamilton et al.,2011; Lee,2004; Obaydi and Puri,2008), and an amplification of autistic symptoms (sensory issues and repetitive behaviours; Hamilton et al.,2011; Lee,2004).

## 1) Track of Menstrual Cycle:

Keeping track of the menstrual cycle is the whole and sole responsibility of the girl's mother. The autistic girl has no idea that she will undergo this process every month. Mother quoted-
"Generally, I set an alarm on a mobile application, but in case of being early or delayed cycle, things get messed up. Mother cited that many times her daughter had returned home unaware that her menses had started during school hours in dirty menstrual clothes."

## 2) Irregular Menstrual Cycle:

As per the data obtained from the girl's mother, the participant generally experiences irregular menstrual cycles, including missed periods, longer or shorter cycles. Mother quoted-
"It is very difficult for her/ school staff to predict the onset of girls' menstrual cycle, which could be due to hormonal changes or medications"

## 3) Pattern of Bleeding:

Menorrhagia, or heavy or excessive menstrual bleeding, is noted by the mother. Despite taking medicines from a gynaecologist, no marked changes had been observed in the pattern of bleeding. Sometimes she is required to change 5-8 sanitary pads.

## 4) Cramps during Menses:

On asking this particular question girl's mother started crying and said, "It must be difficult to handle a special child, but it is way more difficult to handle an autistic child, that too going through a menstrual cycle". She mentioned first three days of every cycle remain very painful, full of cramps, which her daughter could not even communicate to her. All they could do as a

family was arrange for hot water bottles, which sometimes her daughter wouldn't allow her to apply. Mother cited-

"Our family could never forget her first menstrual cycle and cramps, she was so restless that even our neighbours noticed that something was unusual with my daughter".

### 5) Management of Sanitary Napkins:

The girl has not yet learnt to use and change a sanitary napkin; this is done by her mother only. Mother quoted-

"Of late, her daughter has started wrapping up used napkins after proper direction."

Mother has to look after the menstrual hygiene of her daughter as her daughter experiences heightened sensitivity to the physical sensations associated with such as blood flow or the discomfort of sanitary products.

### II. Abuse and Molestation Related Challenges:

The majority of research literature to date has fixated on the peril and pervasiveness of victimisation in autistic youth. Autistic adults experience more relational ill-treatment than non-autistic adults, and the collective pervasiveness rate for poly-victimisation across the lifetime in autism is 84% (Weiss & Fardella, 2018; Thrundle et al., 2022). Autistic youth are three to four times more likely than non-autistic youth to experience sexual victimisation, and between 40% and 50% of autistic adults report experiences of sexual abuse during childhood (Thrundle et al., 2022; Weiss & Fardella, 2018). Similarly, autistic adults report a higher prevalence of sexual harassment and abuse than the neurotypical population (Gibbs et al., 2021). It is critical to note that victimisation is more common among autistic females than autistic males and the neurotypical population (Cooke et al., 2025).

1. **Difference between Good touch and bad touch**

   As per the data gathered, the autistic child was able to differentiate between good touch and bad touch. The mother explained this by saying that she has observed her daughter generally avoid going near unknown people, especially males. But nothing firm can be uttered on this, as such children lack communication.

2. **Autistic girls are more prone to sexual abuse:**

   As per the details obtained, no such thing had happened with the participant. But her mother accepted that the probability of coming across such abuse is higher with her daughter, as she is autistic. Being autistic brings her more chances of repeated sexual assault or abuse, as she lacks any kind of communication. Her daughter even lacks speech; in that case, she can't ask for help if such a situation arises.

"Mother has mentioned this very clearly. When it comes to the safety of my autistic daughter, I can't rely on anybody. I daily accompany her to school and remain seated outside her classroom. I make sure her therapy sessions are done right in front of my eyes, as many males are working there as therapists".

The mother of the girl showed her concern while mentioning that sometimes her daughter starts removing her clothes in front of anyone, further she added that it could be due to an allergy to sensory issues. Mother cited-

"I want to make sure that my daughter learn as soon as possible that she must not remove her clothes only in her room"

3. **Safety Concerns at Public Places:**

As per the data, the participant remains at high risk of exploitation and difficulties in navigating social situations in the absence of communication and social impairment, which are the core characteristics of autism. It had been observed by the mother that her daughter either starts shouting or puts her hands on her ears might be due to sensory overload from noise, crowds, and bright lights.

The mother of the participant mentioned-

"A very good initiative by the school has been taken to run a café, where they train special children for public dealing. My daughter is also being trained there, but I again accompany her there as I don't have faith in anyone".

4. **Lack of ability to commute independently:**

Due to a lack of social interaction, navigating public transport is difficult for the participant. Public transport has difficulties with spatial awareness, potentially leading to safety concerns in crowded or unfamiliar environments.

The mother of the participant cited-

"I don't allow my daughter to commute by bus provided by the school bus, as it lacks any female staff".

**III. Discrimination-Related Challenges:**

People with autism may happenstance countless instances of discrimination (Cleary et al., 2023). For example, tertiary students with autism who, after revealing their diagnosis, report being rejected from real-world placements because of a reluctance to accommodate autism or other disabilities in practice-based settings (Sullivan, 2021).

## 1. Discrimination in the family:

As per the information provided by the mother, the participant's grandmother and brother are very caring and look after her whenever and wherever needed. But a lot of discrimination has been faced by the family when it comes to the extended family, as they never fail to realise them by posing fake concerns. Mother with utter grief on her face quoted-

"I have heard people saying kuch bure karm kiye honge in hone (some bad deeds must be done by them)'

"Hey Bhagwan!!Ek to ladki, upar se autistic, kya hoga iska (oh god, what will happen to this poor autistic girl)"

"Is pagal ladki se shadi kon Karega (who will marry this mad girl)"

The Mother of the participant very firmly mentioned that we have stopped going to such family/social gatherings, which only demotivate us. We remain happy in our world. The mother also recalled that one of his relatives had changed his residence when they were expecting their first baby, as they believed that the shadow of my daughter might bring misfortune for their unborn child.

## 2. Discrimination in Education:

Research has constantly reported discrimination across all levels of education. Discrimination can take the form of rejection to enrol the child, dismissal from the school, elimination from the class setting to another location, deferral from school, exclusion from educational activities, or refusal to make reasonable adjustments to accommodate an autistic person's needs (WHO,2022). At its worst, there have been instances of autistic students being locked inside a small room by teachers to provide 'time out' (9News, 2015) and, in one instance, even being locked inside a cage during times the autistic student exhibited extreme distress (Cleary et al., 2023b).

In the present study, though no discrimination at her present school is observed, but mother expects more avenues for such children, as present schools are not well equipped, lack trained teachers, and a curriculum. One thing that this mother kept on mentioning is the need for special safety for such girls in and out of school premises.

## IV. Challenges related to healthcare

Discrimination can be found in the processes that support autistic people to access health care, and the responses of health professionals. Discrimination by the health system and staff is often the result of a lack of knowledge and skills relating to various disabilities, including autism (WHO, 2022).

In the present case study, time-to-time anxiety, depression, mood swings, sleep disorders, and eating disorders have been reported in the case of the participant, which could be attributed to hormonal fluctuations and sensory sensitivities. But no proper test/ medication is available. Also, again, it is very risky for such girls to visit any kind of healthcare with proper assistance, despite attaining the age of seventeen.

**V) Future-related Challenges:**

**1) Marriage:**

Marriage or relationship or having a family for such girls is a taboo in society, as nobody would take the chance of marrying her. The first statement mentioned by the mother on the question related to marriage, and she became emotional; she took a long pause. Later, on her own, she again started this topic and said-

"Her grandmother and I both are willing to marry her; there must be someone for my daughter as well. God must have sent her soulmate. I don't have big dreams; I am looking for a suitable boy, maybe an autistic or disabled one. Maybe in future, when we are not here to look after her, they both will be there for each other."

**2) Employment:**

It is very difficult for the autistic girl to find any job or run any sort of business because of her symptoms. The family is spending a lot on the autistic girl; the amount is so much that they have to cut the spending on their second child. They want this girl to get trained in some sort of skills, so that she can fulfil her common needs herself. Mother mentioned-

"I keep on looking for a job advertisement, but found none suitable for my daughter"

**Conclusion**

The life of an autistic girl can be diverse and complex. They may experience significant challenges in leading their lives because of their symptoms. The social and communication impairment is the biggest hurdle when it comes to their safety. The current study also suggests that autistic people's menstrual experiences (Burke et al.,2010; Hamilton et al., 2011; Lee, 2004; Obaydi and Puri, 2008) are in some ways dissimilar from those of non-autistic people, placing extra strain on what can be challenging lives. Such girls undergo many types of social boycotts in the form of unsuitable education, healthcare issues, and various forms of discrimination. The future of an autistic girl remains unpredictable in the dearth of suitable life partners and job prospects.

**Suggestion:**

**I. For Addressing Menstrual Challenges**

**1. Education and awareness**

On the part of the Government/schools/ NGOs, regular drives should be run to increase awareness about menstruation and its potential impact on autistic individuals among families, educators, and healthcare professionals. Such a drive should focus on providing intervention to autistic girls before reaching puberty, specifically designed for the use of sanitary napkins, their proper disposal, and hygiene to be maintained during the menstrual cycle. Early interventions, precisely focusing on the menstrual cycle, will help in preparing the autistic girls to be ready in the future for handling it.

**2. Individualised support:**

As per the need and level of autism, tailored support should be provided at school/ healthcare services.

**II) For Addressing Abuse**

**1. At School**

- Every school should employ female staff when and where required. As in the present case study, there was a sufficient number of female teachers, but therapies were conducted by male staff. In that case school must provide a lady's assistance, proper installation of CCTV camera, and also it should be taken care of by the school that the room allotted for such activity is not in a secluded place.
- Schools must hire at least one female staff member for school buses/vans.

**2. At Home**

- Parents must keep a track of visitors at home. Other than family members, nobody should be allowed to take the autistic child anywhere without proper permission. Probably, an appropriate installation of a CCTV camera should be maintained at the house.
- Only female help should be employed to take care of the autistic girl from the start.
- Parents must teach their autistic girls to change their clothes in private rooms.

**III) Discrimination Related:**

- By promoting equal access to quality education, healthcare and employment discrimination related challenges can be lessen. It can be done by conducting public awareness campaigns and educational programs.
- Encourage and involve men and boys in the conversation that are related to gender equality.

- Promote inclusive workplace, school and communities that value diversity and respect for all gender.

## IV) Future

- Government/NGOs/Schools should provide trainings designed specially for autistic children. Parents should make sure their child get as much as exposure so that they can learn newer skills.

- Marriage should not be considered as a taboo for autistic girls. Families of such children can come forward through various online platform to find out suitable match. It is not necessary that only non-disabled can get married. In case of not finding suitable match, families of disabled person can find suitable matches within.

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# Charting the Constraints and Strategies for Integrating Technology and Open Educational Resources in Teacher Education Programme

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**Abstract**

This empirical study investigates the technical barriers of integrating technology and Open Educational Resources (OER) into Teacher Education Programs. The aim is to identify the challenges educators face and propose strategic solutions to enhance the effectiveness of technology integration in education. The research employed a mixed-methods approach, combining quantitative data from structured questionnaires with qualitative insights to comprehensively understand the current situation. The study's findings reveal that technology integration is crucial for modernizing teaching techniques and addressing students' digital preferences; nonetheless, it poses considerable hurdles. Significant issues include teachers' reluctance to use new technologies, insufficient institutional support, and the necessity for enhanced training to acquire essential skills. The study emphasizes the significance of institutional assistance in overcoming these hurdles and fostering an environment conducive to technological advancement. By addressing these issues, the study provides recommendations for enhancing the integration of technology and Open Educational Resources in teacher education programs. Further, it emphasizes the significance of institutional backing, the advancement of novel pedagogical approaches, and the fostering of a technologically proficient educational environment. Moreover, the study eventually supports working together between schools and teachers to get future teachers ready for a classroom that is always changing and using technology.

**Keywords:** Educational Technology, Open Educational Resources, Teacher Education, ICT

**Introduction**

The integration of technology and Open Educational Resources (OER) has become a crucial strategy in transforming contemporary education, especially within teacher education programs. The integration of technology with Open Educational Resources (OER) creates endless opportunities to develop engaging, accessible, and adaptable learning environments that address the varied needs of teacher trainees. Also, it can be seen in various research that Open Educational Resources (OER) can democratize education by offering free, high-quality

materials, while technology improves the delivery and interactivity of these resources (UNESCO, 2019). Mutually, they possess the capacity to provide teacher trainees with the necessary skills and competencies to effectively manage the complexities of 21st-century classrooms.

Despite the transformative potential, the implementation of technology and OER in teacher education presents significant challenges. A notable obstacle is the digital divide, which restricts access to technological infrastructure, especially in rural or resource-limited institutions. Moreover, numerous teacher educators and trainees do not possess the requisite digital literacy to employ these tools effectively. In the study of Allen and Katz (2020) reported that while awareness of OER is on the rise, its incorporation into curricula is obstructed by issues related to quality, sustainability, and alignment with institutional objectives. Resistance to change and a preference for traditional teaching methods hinder the adoption of innovative practices (Bliss et al., 2013).

A significant challenge in achieving quality assurance in Open Educational Resources has been marked. In the absence of effective evaluation and adaptation mechanisms, institutions may find it challenging to ensure that resources align with educational standards and cater to learners' diverse needs. The lack of consistent policy frameworks for technology adoption and open educational resources (OER) intensifies these challenges, resulting in institutions managing integration efforts autonomously (Wiley et al., 2014).

To have a proper solution to this, a comprehensive approach is needed that incorporates capacity building, collaborative practices, and supportive policies. Studies indicate that professional development programs emphasizing digital competencies can enable educators to effectively utilize technology and open educational resources (Mishra, 2018). Fostering collaboration among educators, institutions, and policymakers can facilitate the co-creation and adaptation of high-quality OER suited to local contexts.

The National Education Policy (NEP) 2020 emphasizes the integration of educational technology to enhance access, improve quality, address inclusion and diversity, and ensure equitable, affordable, and accountable education. It acknowledges India's leadership in information and communication technology (ICT) and other advanced fields. The key highlights of the policy on ICT integration are as follows:

- "To be successful online educators, teachers need the right kind of training and development." It is not a given that an instructor who excels in a traditional classroom would also excel in an online setting. … **Para 24.3**

- "As technology is changing quickly and requires experts to provide high-quality e-learning, a thriving ecosystem must be promoted to develop solutions that not only address India's issues of scale, diversity, and equity but also adapt to the rapidly changing technology, whose half-life is decreasing with each year." **Para 24.5**

- "HEIs will actively participate in the study of disruptive technologies, as well as the development of early iterations of educational resources and programs, including online courses in cutting-edge fields, and the evaluation of their effects on certain fields, such as professional education. HEIs with thousands of students will be in a prime position to expand these teaching and skilling initiatives, which will include specialized training for work preparedness, once the technology reaches a mature state." **Para 23.10**

**Analysis of the Related Literature**

Numerous studies offer educational leaders' options to improve technology integration and execute interventions, hence enhancing students' educational experiences. In 2024, Celeste and Osias examined the barriers to the adoption and execution of technology in educational institutions in the Baungon Districts, Division of Bukidnon, during the 2023–2024 academic year. The findings of the study indicated a spectrum of concerns, with infrastructure and resources obtaining the lowest evaluations, while equity and access garnered the highest ratings. Notwithstanding these challenges, it was evident that technological integration was occurring, particularly in the domains of communication and instructional integration. Comprehensive interviews revealed that educators were committed to employing technology innovatively to provide their pupils with optimal education. Strategic measures are required to enhance technology integration and overcome barriers. Instructors should be afforded opportunities for continuous professional growth.

Further, Panakaje et al. (2024) aimed to investigate the influence of technology integration on the improvement of teaching practices related to student engagement, teacher performance, pedagogical methods, and educator development. This study examined the potential of institutional assistance to enhance the outcome variables. The results demonstrated the significance of incorporating technology into pedagogical practices for educators. Furthermore, the incorporation of technology substantially affects teacher performance and student engagement through the mediation of teacher learning and pedagogical practices. The research revealed that increased institutional support enhances student engagement with technology and instructor effectiveness. This finding also suggested that educators should employ technology to implement varied instructional strategies.

Paskevicius (2023) clarified the possibilities, shortcomings, and future directions for teacher educator programs to incorporate elements of open education into teacher preparation. A short survey of students in a teacher education program in British Columbia, Canada, indicates knowledge deficiencies among teacher candidates. Participant reflections encourage additional investigation into strategies for incorporating open educational practices and materials into teacher education programs. The findings analyze Kahle's (2008) design philosophy, emphasizing the use of technology to promote openness, which corresponds with essential elements in teacher education programs. In 2022, Samed et al. contend that educators have identified numerous substantial barriers that impede the successful incorporation of ICT into their teaching methodologies. The issues stem from several factors, namely slow internet access, the complications arising from power outages (often referred to as load shedding), inadequate infrastructure, insufficient experience in online education, and the necessity for prompt intervention.

## Significance of the Study

The study's significance is as follows:

a. Technology integration and Open Educational Resources (OERs) are influencing policy and practice.  This study aids policymakers and educators in understanding the challenges related to the integration of technology and open educational resources (OERs) in teacher education programs.  It can establish regulations, criteria, and methodologies that facilitate the effective use of technology and OERs in teacher training, thereby improving educational quality.

b. Teacher education programs are crucial for equipping educators to effectively integrate technology and Open Educational Resources (OERs) into their classrooms.  Teacher education programs can improve teacher preparedness by equipping them with essential skills and knowledge, informed by an understanding of the challenges faced during the integration process.

c. Technology and Open Educational Resources (OERs) facilitate the democratization of access to high-quality educational materials and opportunities.  This study aims to enhance educational access and equity, especially in underserved regions, by analyzing the obstacles that hinder participation in teacher education programs.

d. Examining the challenges associated with integrating technology and open educational resources (OERs) in teacher education may lead to innovative concepts and collaborative efforts within the educational sector.  Collaboration among educators, legislators, and

stakeholders can lead to innovative solutions and support joint initiatives aimed at enhancing teacher training through the identification of challenges and limitations.

e. This report may provide a basis for subsequent research and scholarship in technology-enhanced teacher education.   This could stimulate further investigation into particular elements of the integration process, assess alternative methodologies, and examine the long-term effects of technology and OER integration on educational outcomes.

f. The study offers insights into the integration of digital technology and Open Educational Resources (OER) to develop dynamic and interactive pedagogical frameworks, which are crucial for contemporary teacher education.

g. The findings support teacher educators in improving their professional skills through effective technology integration in classroom instruction, thereby enhancing lesson preparation and delivery.

**Objective of the study**

The objective of this research is to accomplish the following.

- To explore the barriers faced by educators in integrating technology and OERs into pedagogical practices.

- To investigate the availability and effectiveness of pedagogical support and training.

- To suggest educational implications for the effective use of technology integration and QERs in the pedagogical environment.

**Research Methodology**

In the current study, the investigators used the descriptive survey approach. Data was collected using both face-to-face and online survey approaches, depending on the nature of the problem. The investigator used the simple random procedure to choose a sample from the target group of teacher educators while keeping the fair probability of selection in mind.

**Sample**

The sample for this study consisted of teacher educators (male and female) enrolled in teacher education institutions at Central University of Jammu and Nagaland University. The sample was drawn at random sampling. A total of 75 teacher educators were taken as samples for the research.

**Tool Used**

For the collection of data, the Self-constructed Technology Integration scale was used by the researchers. The scale has two major domains. The first domain contains close-ended questions and the other contains open-ended questions. The data was taken via Google form.

**Analysis and Interpretation**

For the analysis of the collected data, the researchers have employed the Frequency Percentage for the first domain and content analysis for the second domain.



*Figure 1: Demographic profile of the respondents*
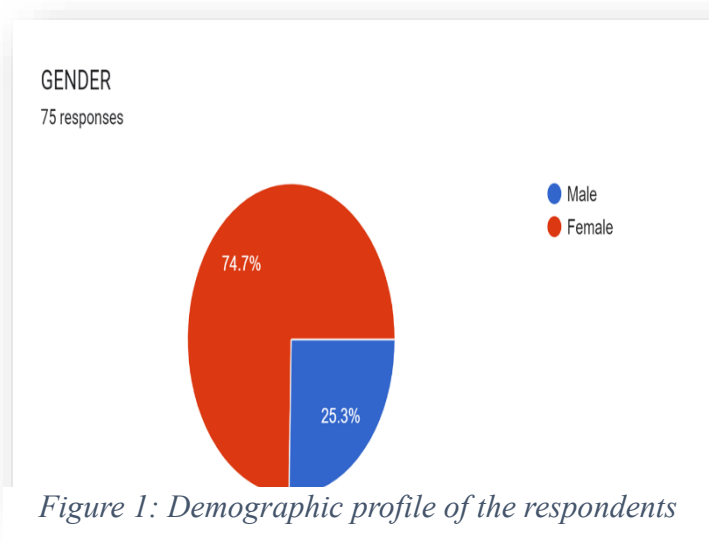
Table 1: Availability and Accessibility of ICT resources in their respective institution

| S. No | Subdimensions | Available % | Non-Available % |
|---|---|---|---|
| 1. | Multimedia projector | 88.00 | 12.00 |
| 2. | Smart boards | 96.00 | 4.00 |
| 3. | Computer lab | 54.67 | 45.33 |
| 4. | Instructional specific software (MOODLE, online based Instructional Software) | 58.67 | 41.33 |
| 5. | Enrichment Material/Reference software in Library (Online encyclopedia, full text magazine and journals) | 77.33 | 22.67 |
| 6. | University Wifi | 62.67 | 37.33 |
| 7. | Departmental Library | 50.67 | 49.33 |

**Table 2: Problems Confronted by teachers while using ICT in their institution**

| S.No | Subdimensions | Never % | Sometimes % | Often % |
|---|---|---|---|---|
| 1. | Poor internet connection (LAN, Wifi) | 10.67 | 68.00 | 21.33 |
| 2. | Lack of availability of resources | 29.33 | 61.33 | 9.33 |
| 3. | Inadequate power supply | 29.33 | 42.67 | 28.00 |
| 4. | Lack of technical assistance | 21.33 | 57.33 | 21.33 |

**Table 3: Problems Confronted while using ICT in their institution**

| S. No | Subdimensions | Never % | Sometimes % | Often % |
|---|---|---|---|---|
| 1. | Basic ICT skills (word processing, presentation, Software, internet use among Teachers in Classroom | 10.67 | 36.00 | 53.33 |
| 2. | Training for integrating technology with pedagogy | 18.67 | 45.33 | 36.00 |
| 3. | Skills to use ICT equipment (interactive whiteboard, digital projectors, laptops) | 12.00 | 42.67 | 45.33 |
| 4. | Lack of aptitude in using technology in Classroom | 24.00 | 62.67 | 13.33 |
| 5. | More focus on Content Coverage | 10.67 | 52.00 | 37.33 |
| 6. | Lack of Initiation form administration to integrate Technology | 10.67 | 36.00 | 53.33 |

The results of the study pointed out that majority of participants agree with the fact that is the availability of some of the physical resources for technology integration in the classroom namely multimedia projector, smartboards, and Material/Reference software in Library whereas only half of the students in the teacher education programme confirms the availability of computer labs, specific instructional software, departmental library and resources etc.

The findings of the study revealed that in most of the problems confronted in teacher education programme in the integration of technology includes the poor Wi-Fi and internet connection in the Institution along with the interrupted power supply within the institution. The study results are in line with the study of Rana & Rana (2020) who reported that the limited ICT infrastructure and teachers' poor ICT knowledge and skills have impacted the expected efficient practice of available digital technology.

Therefore, it is also found that Basic ICT skills (word processing, presentation, Software, internet use among Teachers in Classroom often acts as problem in the effective integration of technology in the teaching learning process.

Further, Skills to use ICT equipment (interactive whiteboard, digital projectors, laptops) and favorable aptitude among teachers in using technology in Classroom are also some other challenges in the inclusion of digital transactional methods. These findings align with the findings of the Johnson et al (2016) and elaborated that technology integration in the classroom will require the ongoing collaborative efforts of teachers, educational technology professionals, school administrators, researchers, and educational software personnel.

**Educational Implications of the Study**

- Availability of basic physical resources should be there in the institution of teacher education if we want to prepare the future teachers and teacher educator as tech-savvy.

- Developing the proper skills and competencies among the teachers of the teacher education programme to use more than basic knowledge related to hardware and software components of the digital aspects.

- Developing the favorable attitude among the teachers' trainers so that they will use the technology more frequently within the classroom. This can be done if they have enough training through FDP and CBP regularly with the stipulated time duration.

- Teachers should have knowledge about technological pedagogical and content knowledge framework so that they have that effective integration of technology as per the nature of the content. (Baliya & Thappa, 2021).

- The faculty should be appreciated with some incentives if they are making sincere efforts in the integration of technology in the classrooms.

**Conclusion**

Integrating technology and Open Educational Resources (OER) into teacher education is full of opportunities and problems. While digital technologies have the potential to improve learning engagement and accessibility, many instructors continue to struggle with inadequate infrastructure, intermittent internet, and a lack of suitable training. Without the proper assistance, technology might feel more like an impediment than an opportunity. To use the power of technology in education, institutions must step up and provide greater support systems, hands-on training, and an innovation-friendly culture. Teachers who use digital technologies in the classroom should feel competent and empowered, not overwhelmed. Together, educators, policymakers, and institutions can establish a setting where technology complements education rather than makes it more difficult. Thus the objective is straightforward i.e. to provide aspiring educators the abilities and self-assurance they need to create vibrant, technologically advanced classrooms that motivate and excite the next generation of students.

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# Enhancing Cybersecurity Awareness Among Undergraduates in Assam: An Experimental Intervention Approach

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**Abstract**

This study investigates the effectiveness of a targeted intervention program in enhancing cybersecurity literacy among undergraduate university students of Assam. A total of 80 students were selected using convenient sampling, and the research employed a pretest-posttest non-equivalent control group design within a quasi-experimental framework. Quantitative data were analyzed using the Mann-Whitney U test and intensity index. The findings revealed a significant improvement in cybersecurity literacy among the experimental group compared to the control group. Intensity analysis also revealed that the intervention programme provided relevant information and enhanced behavioural aspects among learners. The study concludes that structured intervention programs are effective in fostering cybersecurity literacy. It emphasizes the need for their integration into higher education curricula to prepare students for the challenges of an increasingly digitalized world.

**Keywords:** Cyberliteracy, cybersecurity, students, higher education, intervention.

**Introduction**

In today's digital age, cybersecurity literacy has become an essential competency for individuals navigating the online world. The proliferation of technology in everyday life has brought unparalleled convenience, but it has also introduced significant vulnerabilities. Cyberattacks, such as phishing, ransomware, and data breaches, have escalated in frequency and sophistication, making digital security a pressing concern globally (Von Solms & Van Niekerk, 2013). Despite this reality, research consistently reveals a lack of basic cybersecurity knowledge and practices among young adults, particularly university students, who are among the most active users of digital platforms (Hadlington, 2017; Haque, 2023).

Cybersecurity awareness encompasses understanding potential risks and adopting behaviours to mitigate those risks effectively. However, existing studies suggest that educational institutions have not adequately integrated cybersecurity into their curricula (Jagdeesan et al., 2023; Oluwatosin, 2024; Binh, 2023), leaving a gap in students' preparedness to handle cyber threats (Livingstone & Haddon, 2012). Given the critical role that university students will play

in the future workforce and society, empowering them with cybersecurity literacy is imperative.

**Cybersecurity**

Protecting computer systems, networks, and data against online attacks using tools like firewalls and encryption is known as cybersecurity, and it is crucial for defending against ever-changing cyber threats (Rajani and Thakur, 2024). However, some authors argued that cybersecurity encompasses more than data security, including disinformation and social media threats. It involves technical measures and institutional efforts to safeguard against cyber threats and promote collective cybersecurity in cyberspace (Miller & Bossomaier, 2024). According to Miller et al. (2024), cybersecurity is different from cyber safety because cybersecurity is committed against intentional harm, but safety word used against accidental harm. This cyber security can be practiced when we have awareness and knowledge of the potential threats.

**Cybersecurity: Awareness, Knowledge, Behaviour**

Cybersecurity awareness, knowledge, and behaviour are interconnected but distinct aspects of an individual's ability to navigate the digital landscape securely. Cybersecurity awareness refers to the understanding of potential cyber threats, such as phishing, malware, or data breaches, and recognizing the importance of protective measures. It serves as the first step in fostering a secure digital environment by helping individuals identify risks. Cybersecurity knowledge goes a step further by encompassing the technical and procedural understanding required to respond to and mitigate these threats effectively. This includes knowing how firewalls, encryption, and multi-factor authentication work, as well as understanding organizational policies. The proper knowledge of the individual pushes towards practicing the event (Lee& Chua, 2023). Cybersecurity behaviour, in contrast, reflects the practical application of awareness and knowledge. It entails the consistent execution of secure practices, such as creating strong passwords, avoiding suspicious links, and updating software regularly. These three components are collectively called literacy.

**Cybersecurity Literacy**

The ability to comprehend, evaluate and successfully address cyber hazards and security difficulties in the digital world is known as cybersecurity literacy. It includes the fundamental understanding of cybersecurity concepts—like identifying threats like malware, phishing, and social engineering and the hands-on abilities required to put preventative measures into place, like creating strong passwords, turning on multi-factor authentication, and keeping software updated. Critical thinking abilities are also necessary for cybersecurity literacy in order to

evaluate the reliability of material found online, identify harmful intent, and adopt safe practices in both personal and professional settings.

Cybersecurity literacy is especially focused on maintaining safe interactions inside the digital domain, as opposed to general digital literacy, which emphasizes the capacity to use digital tools efficiently. In the linked world of today, when people and organizations must contend with constantly changing cyber threats, it is a critical ability.

**Review of literature**

The study by Lim et al. (2021), titled Towards Effective Cybercrime Intervention, aimed to analyze the impact of interventions on students' understanding of cybercrime consequences. Using secondary data, it revealed that such interventions help students grasp the harmful effects of cyber-attacks on systems and livelihoods, potentially deterring malicious activities. The study also highlighted the importance of instilling ethical cyber practices and inspiring careers in cybersecurity. Singaravelu and Pillai (2014) investigated cybercrime awareness among 200 B.Ed. students in the Perambalur district using a normative survey method and cluster sampling. Their study found low awareness levels across urban and rural students, with no significant differences based on location, computer ownership, or participation in cyber forums.

Khan et al. (2018) explored Cyber Crime Awareness Among MSW Students, School of Social Work, Mangaluru, surveying 100 students. The study revealed that 68% were somewhat familiar with the term "cybercrime," while only 22% were very familiar. Students identified various components of cybercrime, with the majority recognizing its intersection with networks, technology, and human involvement. Financial institutions emerged as the most vulnerable to cybercrime. Mobite et al. (2023), in their study Awareness About Cybercrime Among College Students, analyzed 50 students from various disciplines in Narhe using stratified random sampling. The results showed that most participants had antivirus software, were cautious about online activities, and shopped only on trusted websites. They also expressed confidence in safeguarding personal devices and supported legal frameworks against cybercrime.

Sahu and Shukla (2024) conducted a study on Cyber-Crime Awareness Among Students in Chhattisgarh, examining 60 students from urban and rural areas of Pt. Ravishankar University. They aimed to assess awareness levels, revealing variations across gender and location. Rajasekar (2011) employed a questionnaire-based survey to analyze cybercrime awareness among students, considering gender and location. Using t-tests, the study found no gender differences but significant rural-urban disparities in understanding cyber threats. Similarly,

Narahari and Shah (2016), in their study on Cyber Crime and Security Awareness Among Young Netizens of Anand, Gujarat, reported that 47% of participants were somewhat familiar with cybercrime, while 36% were very familiar. Awareness of specific cyber threats like hacking was relatively high (64.4%), but knowledge of issues like phishing and cyberbullying remained low.

Malhotra and Malhotra (2017) studied Cybercrime Awareness Among Teacher Trainees in Haryana, sampling 240 trainees from six colleges using a random selection method. Most participants exhibited moderate awareness (62%), with only a minority achieving high or excellent levels. Lastly, Bhate (2023) investigated Cyber Security Awareness Among Female University Students at The Maharaja Sayajirao University of Baroda, engaging 167 participants in an online survey. The study found low awareness of terms like phishing and cyberstalking but noted better understanding in areas such as passwords and social media security. An awareness session significantly improved knowledge, emphasizing the need for more extensive training efforts.

The review of the literature highlights several studies exploring cybercrime awareness among various demographic groups, such as students, teacher trainees, and young netizens, using diverse methodologies. While these studies underscore the importance of understanding cyber threats, gaps remain in comprehensively addressing cybersecurity literacy as a multi-dimensional construct encompassing both awareness and knowledge, skills, and ethical behaviour in digital environments. Most research focuses on descriptive awareness levels or demographic differences, often neglecting the depth of actionable cybersecurity practices and critical thinking skills needed to prevent cyber threats. Moreover, limited attention is given to tailored interventions that incorporate experiential or technology-integrated approaches to foster long-term behavioural change. One study reported in special reference to the M. S. University of Baroda, which only emphasizes the awareness aspect. After reviewing the above studies, researchers identified a scarcity of cybersecurity literacy aspect. Addressing these gaps is critical to transitioning from awareness to actionable literacy, ensuring individuals not only recognize cyber risks but also confidently navigate and secure digital spaces.

**Rationale**

The rapid digitization of daily life has made cybersecurity a critical concern for individuals, organizations, and societies. As active participants in the digital ecosystem, university students often lack adequate awareness and preparedness to navigate the complexities of cybersecurity risks. While many are proficient in using technology, they are frequently unaware of best practices for protecting personal information, safeguarding digital assets, and mitigating threats

such as phishing, malware, and identity theft. In the Indian context, Indian residents lost more than Rs 1,750 crore as a result of cybercrime between January and April of 2024. The Ministry of Home Affairs oversees the National Cybercrime Reporting Portal, where more than 740,000 complaints have been filed. If we see trends, in the year 2021, a total of 52974, and in 2022, 65893 (Manral, 2023), in the year 2024, a total of 740000 cases were registered. This is showing a drastic increase in cybercrime incidence in India. The National Crime Record Bureau's data stated that 44,546 cases of cybercrimes were registered in 2019 as compared to 28,248 in 2018. The highest number of cybercrime cases were registered in Karnataka (12,020) closely followed by Uttar Pradesh (11,416), Maharashtra (4,967), Telangana (2,691) and Assam (2,231) (NCRB, 2019). Assam being one of the hotspot for cybercrime has seen the rise in the rate of cybercrimes in the last few years tremendously. National Crime Bureau (NCB) data reveals that a total of 2,231 cybercrime cases were registered in the State in 2019, which went up to 3,530 cases in 2020 and in 2021, cybercrimes in the State shot up to 4,846 cases, which is 13.8 per cent higher than the then National Rate. About 60 per cent of the youth of Assam face mental health issue due to cyber bullying (UNICEF: NSS Study). But the alarming data is that, even after such high number of cybercrime cases in Assam, the youth or the people of Assam hesitate to report it to the authority (The New Indian Express, 2024).

The researcher analyzed the curriculum of universities in Assam. The universities run no syllabus or literacy programme as part of the curriculum. Oluwatosin (2024) and Jagdeesan et al. (2023) also identified the lack of cybersecurity courses in the institution. In this continuum from the reviews, the researcher identified the scarcity of literature on cybersecurity literacy and intervention programmes on cybersecurity literacy. This gap in cybersecurity literacy underscores the urgent need for targeted educational interventions. Developing effective training programs that equip students with the knowledge and skills to identify and address cybersecurity threats is essential for fostering responsible digital citizenship. Such efforts not only enhance personal security but also contribute to broader societal resilience against cybercrime and digital exploitation.

By assessing the current levels of cybersecurity awareness among university students, the study identifies critical areas of vulnerability and knowledge deficits. Drawing on these insights, it proposes a structured and evidence-based training program designed to empower students with practical strategies to enhance their cybersecurity practices.

**Research Questions**

1. How far does the intervention programme enhance literacy on cybersecurity among learners?

**Objectives**

1. To analyse the curriculum of the State University with respect to the cybersecurity programme.

2. To develop an intervention programme to enhance literacy on cybersecurity among learners.

3. To check the effectiveness of the intervention programme for enhancing literacy on cybersecurity among learners.

4. To study the reaction of the learners to the intervention programme.

**Hypothesis**

$H_{01}$: There is no significant difference between the mean scores of post-test scores of the experimental and control groups.

**Operational definition of the terms**

**Effectiveness of the intervention programme:** The effectiveness of the intervention programme is the difference between the mean scores of the post-test scores of the experimental and control groups.

**Intervention Programme:** This intervention programme provides literacy training on cybersecurity. This programme includes components of cybersecurity, cyber threats, cybersecurity myths, laws on cybersecurity, precaution, and safety measures.

**Methodology**

This is an experimental study. The present study followed the quasi-experimental pre-test and post-test control group design. The study population was university students from Guwahati. The study sample was 80 university students selected by purposive sampling. The purpose of the sampling was the availability of the students for experimentation and permission granted by the faculty deans for experimentation in the faculty.

**Tools**

**Achievement Test:** This test was a self-prepared tool. This test consists of a total of 25 items. In this test, the researchers took all aspects of the programme to assess the objective attainment by the students. This test includes the awareness, knowledge and behavioural aspects of the programme. The '1' mark was assigned for each correct answer, and the '0' mark was assigned for each wrong answer.

**Reaction Scale:** This is a Likert-type scale. This scale was used to know the reaction of the students towards the programme. A total of 10 items are present in the scale.

**Data Collection**

For the data collection, the researchers conducted sessions in person. First of all, the researcher administered a pre-test on students of both groups. After this, the experimental group was treated with the intervention programme. The intervention programme is divided into two parts, i.e. theory and practical. In the first phase, the experimental group was taught through the theory aspect; after that, all students underwent a practical session where the researcher asked them to identify and adopt strategies through which they could protect themselves.

**Data Analysis and Result**

**Objective 1:** To analyse the curriculum of the State University with respect to the cybersecurity programme.

**Result:** In the analysis of the curriculum of the state universities of Assam state, the researchers were unable to find any specific paper or course that is concerned with cybersecurity. Researchers also found that no credits were assigned to cybersecurity topics.

**Objective 2:** To develop an intervention programme to enhance literacy on cybersecurity among learners.

**Result:** An intervention programme consisting of PowerPoint presentation, lecture session and practical session on topics related to different cyberthreats, common myths regarding cybercrimes, cybersecurity measures, cybercrime reporting process and government laws concerning cybercrimes in India was developed and given to the experimental group.

**Objective 3:** To check the effectiveness of the intervention programme for enhancing literacy on cybersecurity among learners.

**Table. 1: Post-Test Achievement Scores of Groups**

| Groups | N | Mean | Minimum | Maximum |
|---|---|---|---|---|
| **Control** | 40 | 14.625 | 10 | 24 |
| **Experimental** | 40 | 18.05 | 14 | 23 |

**Result:** Table no. 1 shows that the mean score of the control group was 14.62 while as mean score of the experimental group was 18.05.

$H_{01}$**:** There is no significant difference between the mean scores of post-test scores of the experimental and control groups.

**Table. 2: Comparison Between Post Test Scores of the Control and Experimental Groups**

| Groups | N | Mean Rank | U-Value | Z-Value | Result |
|---|---|---|---|---|---|
| **Control** | 40 | 26.25 | 1370.000 | 5.518 | Significant |
| **Experimental** | 40 | 54.75 | | | |

**Result:** Table no. 2 shows that the mean rank of the control group was 26.25, and the experimental group was 54.75. The U-value was 1320, and the Z-value was 5.518. in the case of Mann-Whitney U, if the value of N is more than 20 (N>20), then significance is decided by the Z-value. When the value of Z is more than 2.56 (Z>2.56), then U is significant at the 0.01 level. Since Table no. 2 shows that the Z-value was 5.518 therefore, U is significant at 0.01 level, and the null hypothesis fails to be accepted.

**Interpretation:** The result shows that U is significant at 0.01, which means the experimental group possess a higher level of literacy than the control group after the implementation of the intervention programme. It shows that the intervention programme is effective for enhancing literacy on cybersecurity among university students.

**Objective 4:** To study the reaction of the learners to the intervention programme.

**Table 3: Intensity and Percentage Analysis of Reaction for the Intervention Programme**

| Sr | Item | SA | A | UD | DA | SDA | Intensity |
|---|---|---|---|---|---|---|---|
| **1** | The program increased my understanding of key cybersecurity concepts. | 30 | 10 | 0 | 0 | 0 | 4.7 |
| | | 75 | 25 | 0 | 0 | 0 | |
| **2** | I feel more confident identifying and avoiding phishing emails after attending the program. | 28 | 10 | 2 | 0 | 0 | 4.6 |
| | | 70 | 25 | 5 | 0 | 0 | |
| **3** | The program provided practical and actionable tips for securing my digital devices. | 20 | 10 | 5 | 5 | 0 | 4.1 |
| | | 50 | 25 | 12.5 | 12.5 | 0 | |
| **4** | The content of the program was engaging and easy to understand. | 25 | 15 | 0 | 0 | 0 | 4.6 |
| | | 62.5 | 37.5 | 0 | 0 | 0 | |
| **5** | | 18 | 15 | 2 | 5 | 0 | 4.1 |

| | Statement | | | | | | |
|---|---|---|---|---|---|---|---|
| | The hands-on activities and demonstrations were effective in enhancing my learning. | 45 | 37.5 | 5 | 12.5 | 0 | |
| 6 | I feel more aware of the potential cyber threats in my personal and academic life. | 30 | 8 | 2 | 0 | 0 | 4.7 |
| | | 75 | 20 | 5 | 0 | 0 | |
| 7 | The program has motivated me to adopt safer online practices (e.g., stronger passwords and two-factor authentication). | 30 | 5 | 0 | 5 | 0 | 4.5 |
| | | 75 | 12.5 | 0 | 12.5 | 0 | |
| 8 | The duration of the program was sufficient to cover the intended topics effectively. | 15 | 5 | 3 | 10 | 7 | 3.2 |
| | | 37.5 | 12.5 | 7.5 | 25 | 17.5 | |
| 9 | The program addressed real-life scenarios that I might encounter in my daily online activities. | 23 | 10 | 3 | 4 | 0 | 4.3 |
| | | 57.5 | 25 | 7.5 | 10 | 0 | |
| 10 | Overall, I found the cybersecurity program to be a valuable and worthwhile experience. | 35 | 5 | 0 | 0 | 0 | 4.8 |
| | | 87.5 | 12.5 | 0 | 0 | 0 | |

**Result:** The overall intensity was 4.3, which shows the favourable reactions of the respondents towards the intervention programme.

**Statement 1: The program increased my understanding of key cybersecurity concepts.**

**Interpretation:** 100% of respondents agreed that the program enhanced their understanding of cybersecurity concepts (75% strongly agreed). With an intensity score of 4.7, the program effectively achieved this objective.

**Statement 2: I feel more confident identifying and avoiding phishing emails after attending the program.**

**Interpretation:** 95% of respondents felt more confident in identifying phishing emails, with 70% strongly agreeing. The intensity score of 4.6 reflects the program's success in boosting confidence in this area.

**Statement 3: The program provided practical and actionable tips for securing my digital devices.**

**Interpretation:** 75% of respondents agreed the program offered practical tips, but 12.5% expressed neutrality and another 12.5% disagreed. The intensity score of 4.1 indicates moderate effectiveness in this area, with room for improvement.

**Statement 4: The content of the program was engaging and easy to understand.**

**Interpretation:** 100% of respondents agreed the content was engaging and comprehensible (62.5% strongly agreed). The high-intensity score of 4.6 suggests excellent delivery of content.

**Statement 5: The hands-on activities and demonstrations were effective in enhancing my learning.**

**Interpretation:** 82.5% agreed on the effectiveness of hands-on activities, though 5% were neutral and 12.5% disagreed. With an intensity score of 4.1, this aspect was effective but may need refinement for better engagement.

**Statement 6: I feel more aware of the potential cyber threats in my personal and academic life.**

**Interpretation:** 95% of respondents felt more aware of cyber threats, with 75% strongly agreeing. The intensity score of 4.7 highlights a strong impact in raising awareness.

**Statement 7: The program has motivated me to adopt safer online practices (e.g., stronger passwords and two-factor authentication).**

**Interpretation:** 87.5% agreed that the program encouraged safer online practices, but 12.5% disagreed. The intensity score 4.5 indicates a positive motivational impact with slight room for improvement.

**Statement 8: The duration of the program was sufficient to cover the intended topics effectively.**

**Interpretation:** Only 50% of respondents agreed that the program's duration was sufficient, while 42.5% expressed dissatisfaction (25% disagreed, and 17.5% strongly disagreed). The low-intensity score of 3.2 indicates this is a significant area for improvement.

**Statement 9: The program addressed real-life scenarios that I might encounter in my daily online activities.**

**Interpretation:** 82.5% agreed the program addressed relevant scenarios, but 10% disagreed. The intensity score 4.3 suggests good relevance overall but highlights minor gaps in connecting with real-life applications.

**Statement 10: Overall, I found the cybersecurity program to be a valuable and worthwhile experience.**

**Interpretation:** 100% of respondents found the program valuable, with 87.5% strongly agreeing. The highest intensity score of 4.8 underscores the program's overall success.

**Overall Interpretation:**

High effectiveness in increasing understanding, confidence, and awareness of cybersecurity.

Overall, the value and engagement of the program were highly appreciated. However, respondents suggested that programme duration should have more duration.

**Discussion**

The study results indicate that the intervention program was highly effective in enhancing cybersecurity literacy among university students. The findings align with previous literature and underscore the necessity of structured educational programs for bridging gaps in cybersecurity awareness, knowledge, and behaviour. Similar to Jonathan et al. (2021) and Bhate (2023), who observed positive outcomes from targeted awareness sessions, this study demonstrates significant improvements in students' understanding of cybersecurity concepts and confidence in mitigating threats like phishing. The program's high-intensity scores (e.g., 4.7 for knowledge enhancement and 4.6 for content engagement) confirm its relevance and impact, consistent with recommendations by Oluwatosin (2024) for integrating cybersecurity training in higher education.

However, the results also reveal challenges. A relatively lower score of 3.2 for program duration sufficiency suggests the need for extended sessions to cover topics comprehensively. These findings are echoed in studies like Sahu and Shukla (2024), highlighting the importance of adequately timed interventions for fostering deeper learning. Moreover, the moderate effectiveness in practical application (e.g., securing digital devices) suggests room for refining hands-on activities.

Overall, the study reinforces the literature's call for incorporating cybersecurity literacy as a curricular component, emphasizing experiential learning for fostering actionable knowledge and behavioural change.

**Conclusion**

The study highlights the effectiveness of a structured intervention program in enhancing cybersecurity literacy among university students. The program significantly improved students' understanding of cybersecurity concepts, confidence in identifying threats, and motivation to adopt safer online practices. These findings align with existing research that emphasizes the importance of targeted educational initiatives in addressing gaps in cybersecurity awareness, knowledge, and behaviour. This research advocates for the inclusion of comprehensive cybersecurity training as an essential component of academic programs, ensuring that students are equipped to face the challenges of the digital age.

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# Creating Self-Employment and Financial Independence: Contrasting Micro-Finance Banks, Micro-Finance Institutions and their Rural Support Campaigns

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## Abstract

In order to promote self-employment and financial independence in rural communities, this study compares the functions of microfinance banks (MFBs) and microfinance institutions (MFIs). Although the goal of both organizations is to offer financial services to marginalized communities, there are notable differences between their outreach tactics, operational structures, and developmental effects. The study looks at how MFIs—which are frequently non-profit or NGO - driven—emphasize community-based support, group lending, and grassroots participation, whereas MFBs, with their conventional banking structures, provide regulated loan and savings products. Campaigns for rural support, such as those focusing on women, business training, and financial literacy, receive particular emphasis. The study illustrates the efficiency of integrated microfinance strategies in lowering poverty, encouraging inclusive growth, and facilitating sustainable livelihoods using case studies and field data.

Keywords: Micro-finance banks (MFBs), Micro-finance institutions (MFIs), Self-employment, Financial independence, Rural development, Financial Inclusion.

## Introduction

Poverty reduction and economic empowerment are made more challenging in many developing nations because of the continued lack of access to formal financial services, particularly in rural regions. Microfinance has emerged as a revolutionary tool that bridges this gap by providing small-scale financial services to underserved groups. Microfinance institutions (MFIs) and microfinance banks (MFBs) play significant yet distinct roles in motivating self-employment and financial independence in this sense.

MFBs are usually licensed financial organizations that provide a structured insurance, savings and credit product with focus on scalability and sustainability. MFIs, conversely, that tend to be cooperatives or non-governmental organisations, put a high value on social development initiatives, group lending policies, and community participation. Both models have initiated targeted rural support programs in an attempt to encourage inclusive growth, i.e. financial literacy programs, entrepreneurial education, and women-specific programs.

So as to serve rural populations, to go beyond subsistence to self-sufficiency, this paper will objectively compare the benefits of MFBs and MFIs on the same basis. To identify best practices and recommend a hybrid approach that can leverage the benefits of both models, the study will analyze their operational models, outreach strategies, and socioeconomic impacts of the models. In doing so, it contributes to the bigger discussion on equitable financing, sustainable development and local economic resiliency.

**Need of the Study**

In many developing nations, like India, rural poverty and unemployment continue despite decades of development attempts. Traditional banking institutions often fail to reach rural poor people because of factors such as distance, credit history, and collateral. Here, microfinance banks (MFBs) and MFIs are among the alternative service providers of financial products and services that aim to fill this need. Nonetheless, it is imperative to assess and compare how well these two models support independent work and financial security:

**Lack of Comparative Research**: While both MFBs and MFIs aim to empower underserved populations, few studies have systematically compared their operational models, outreach strategies, and long-term impact on rural livelihoods.

**Rural Economic Empowerment**: Understanding which model better supports **entrepreneurship, income generation, and financial literacy** is essential for designing effective rural development policies.

Women **and Marginalized Groups**: Many rural support campaigns target women and marginalized communities. Evaluating how MFBs and MFIs differ in their inclusivity and empowerment outcomes is vital for **gender-sensitive policy formulation**.

**Policy and Program Design**: Policymakers and development agencies require evidence-based insights to allocate resources efficiently and **scale up successful models** of micro-finance delivery.

**Sustainable Development Goals (SDGs)**: This research is both important and topical since it is in line with global objectives like SDG 1 (No Poverty), SDG 5 (Gender Equality), and SDG 8 (Decent Work and Economic Growth).

**1. Materials and Methods**

Microfinance applications follow the same rules as any other financial requirements. Microfinance institutions are subject to a code of conduct and a set of eligibility requirements determined by an appropriate network. Microfinance Institutions Network is the name given to this kind of network. Microfinance solutions are readily available now, thanks to the efforts of

several institutions.

**Table 1:** The following is an accounting statement of all outstanding microfinance loans for the fiscal year 2016–17:

| Organizations | Figures (in Rs crores) |
|---|---|
| NBFC-MFI | 44519 |
| BANKS | 40993 |
| SFBs | 14477 |
| NBFCs | 6026 |

Data to be collected by industry association MFIN indicates that the micro-finance sector's loan portfolio grew by 26% in 2016–17, with a total of Rs 106.916 cr outstanding, according to The Telegraph (May 22, 2017). In terms of microfinance lending, NBFC-MFIs accounted for 42% of the total, while banks accounted for 38% and small finance banks for 14%. Agribusinesses and rural businesses are already making use of microfinance, and there are calls for more long-term strategies to increase rural residents' access to this kind of financing. When trying to establish a new firm, women entrepreneurs encounter several obstacles when trying to get funding. Microfinance allows enterprises to explore new avenues.

There are two main categories of Indian financial institutions that have developed throughout the years: official and informal. Private banks, regional rural banks (RRBs), public sector commercial banks (CBs), and cooperatives make up the formal system's multi-agency approach. Within the realm of government, you'll find the public sector banks and RRBs.

Participants in the unofficial system include merchants, dealers, and Rotating Savings and Credit Associations (ROSCAS). Institutions and individuals with a vested interest in the matter have established standards and regulations that regulate each of these.

## Review of Literature

**Armendáriz & Morduch (2005)** – In The Economics of Microfinance, the authors explore how MFIs empower the poor, especially women, through group lending and social collateral. They argue that MFIs are more effective in reaching the ultra-poor than traditional banks.

**Kabeer, N. (2001)** – In World Development, Kabeer emphasizes that microfinance enhances women's economic agency and challenges gender norms, but its success depends on the socio-cultural context and program design.

**Duflo et al. (2013)** – A randomized evaluation of microcredit in India found **limited short-term impact** on health and education, but noted increased business activity and borrowing among treated households.

**Sangeetha G. (2023)** – In her study on MFIs and financial inclusion, she found that MFIs significantly improve access to credit, especially in rural areas, and contribute to **entrepreneurship and poverty reduction**.

**David Lee (2022)** – More financial inclusion and economic progress, particularly in rural areas, are associated with strong microfinance industries, according to a research that compared Asian nations.

**Lavakush Singh (2023)** – His comprehensive review highlights the evolution of microfinance from informal lending to institutionalized models like MFBs and MFIs. He notes that **hybrid models** combining social outreach and financial discipline are most effective.

**Nasir, S. (2013)** – This study critiques the operational gaps in Indian MFIs, such as overlapping clients and lack of product diversity, and calls for **regulatory reforms** to improve outreach and sustainability.

**Emily Brown (2021)** – Found that **well-managed MFIs** can significantly improve financial literacy and reach unbanked populations, especially when paired with digital tools and rural campaigns.

**Barinaga, E. (2013)** – Explored the use of microfinance in Sweden and found that it can be a tool for **social capital generation** and inclusion even in developed welfare states, suggesting its universal relevance.

**Undurraga & Pokorny (2024)** – Their systematic review of rural development interventions emphasizes that **contextual support**, such as infrastructure and education, enhances the impact of microfinance on self-employment and resilience

## Methodology

This study adopts a **comparative and descriptive research design**, aiming to analyze and contrast the operational models, outreach strategies, and socio-economic impacts of **Micro-Finance Banks (MFBs)** and **Micro-Finance Institutions (MFIs)** in rural development.

The microfinance industry has also grown substantially in India. As a result, chances for small businesses have grown. At the same time, more people are finding work. At present, the microfinance industry in India is comprised of NABARD in Mumbai;

**Figure 1: A Systematic Review of Microfinance Organizations**
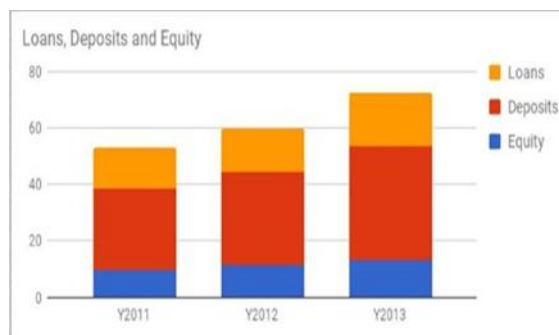


**Interpretation:** The three key elements of microfinance, in terms of the statistics provided below are loans, deposits, and equity. The column chart above depicts the percentage change in the three mentioned categories that increased gradually between the year 2011 and 2013. For instance, in

- Small Industrial Development Bank of India (SIDBI), Lucknow;
- Rashtriya Mahila Kosh (RMK), a government-initiated NGO under the department of Women & Child Development;
- Housing &Urban Development Corporation (HUDCO), New Delhi;
- Housing Development Finance Corporation (HDFC), Mumbai;
- Friends of Women's World Banking (FWWB), Ahmedabad.

Intermediary agencies, which include microfinance institutions, assisting non-governmental organizations (NGOs), and scheduled, regional, rural, and cooperative banks, make up the next section of the industrial mapping.

Banks were provided with a 14-point action plan that addressed women's access to credit. This strategy aims to collect factual data on women's financing, including the number of funded, the amount of credit flowed to them, and their proportion to net bank credit, by the conclusion of the first year of implementation.

## 2. Data

Information on micro-financial aid that various low-income enterprises have received throughout the years is as follows:

Organization that promotes rural employment and education via individual assistance. Women in rural India now have easier access to microfinance and other forms of financing thanks to SEWA.

**Chart 2: Regional 2012 Funding Sources (in USD Billion)**
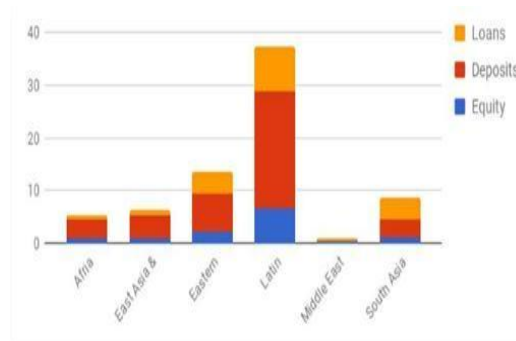


**Interpretation:** Investment in microfinance has been a boon in many nations and continents, including India. The preceding figure, however, shows that the Caribbean and Latin America have actively sought out the highest levels of investment in microfinance.

**Chart 3: Sources of Funds in 2012, according to Legal Status (in USD Billion)**
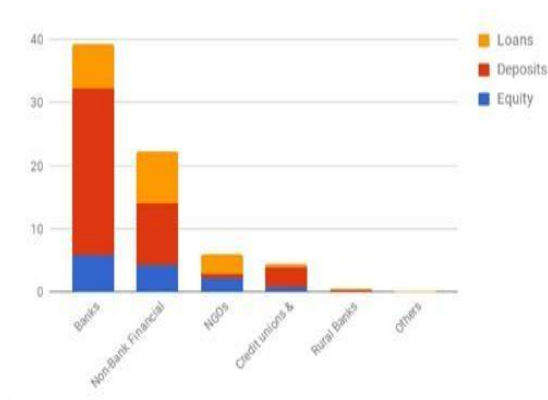


**Interpretation:** The establishment of micro-finance has been greatly facilitated by banks. The distribution of microfinance has been distributed as follows: 26.5% to banks, 9.7% to NBFIs, 3.1% to credit unions and cooperatives, 0.8% to NGOs, and 0.3% to rural banks. Also, as you can see from the figure above, loans and equity were major components of microfinance at various organizations.

In order to lend to businesses who do not yet have credit records, microfinance companies borrow money from more traditional lenders such as banks. This is mostly due to the fact that these entrepreneurs are from low-income backgrounds and hence have a hard time securing startup funding. Microfinance loans often have very modest amounts, perhaps as little as $100. These days, microfinance also offers services like money transfers, insurance, and savings accounts.

Notable India-based MFIs

| | |
|---|---|
| Arohan | Prioritize tasks such as budgeting, managing cash flow, but also |
| Sonata | To make microfinance financially self-sustainable |
| Bandhan | Dual objective -poverty alleviation & women empowerment |
| SKS Bharat Financial Inc. | Provide financial services to poor & poverty alleviation |
| Asmitha | Bridge gap between poverty & a comfortable SOL |

**Findings**

**1. Access to Financial Services**

- MFIs tend to have **greater outreach** in remote rural areas due to their flexible, community-based models.

- MFBs offer more **structured and regulated financial products**, but often require documentation and credit history, limiting access for the poorest.

**2. Impact on Self-Employment**

- Both MFBs and MFIs contribute to **micro-enterprise development**, but MFIs are more effective in supporting **first-time entrepreneurs**, especially women.

- MFBs are more likely to fund **growth-stage businesses** due to their larger loan sizes and formal underwriting processes.

**3. Women's Empowerment**

- Researchers have shown that microfinance institutions (MFIs), particularly those based on Self-Help Group (SHG) models), greatly improve women's involvement in earning money, making decisions, and climbing the social ladder.

- MFBs contribute to empowerment but often lack the **community engagement** and training components that MFIs provide.

**4. Financial Literacy and Capacity Building**

- MFIs frequently integrate **financial literacy, entrepreneurship training, and mentoring** into their rural campaigns.

- MFBs focus more on **product delivery** than on capacity-building, though some are beginning to adopt hybrid models.

## 5. Economic Outcomes

- Beneficiaries of both models report **increased income stability**, **asset accumulation**, and **improved savings behavior**.

- MFIs show stronger results in **poverty alleviation** among the ultra-poor, while MFBs are more effective in **scaling up** existing businesses3.

## 6. Social Capital and Community Development

- MFIs foster **social cohesion** through group lending and peer accountability, which enhances repayment rates and mutual support.

- MFBs, being more transactional, have limited impact on **social capital formation**.

# Suggestions

## 1. Promote Hybrid Micro-Finance    Models

- Encourage collaboration between **MFBs and MFIs** to combine the **institutional strength** of banks with the **grassroots outreach** of NGOs.

- Develop joint rural campaigns that blend financial products with community-based training and support.

## 2. Strengthen Rural Support Campaigns

- Expand **financial literacy programs**, especially for women and first-time borrowers.

- Integrate **entrepreneurship training** with access to micro-loans to ensure sustainable self-employment.

## 3. Leverage Digital Finance Tools

- Promote **mobile banking, digital wallets, and fintech platforms** to reduce transaction costs and improve access in remote areas.

- Train rural populations in using digital tools for savings, credit, and business management.

## 4. Customize Financial Products

- Design **need-based loan products** tailored to rural livelihoods (e.g., agriculture, handicrafts, small retail).

- Introduce **flexible repayment schedules** aligned with seasonal income cycles.

## 5. Enhance Group Lending Models

- To promote responsibility and peer support, it is recommended to enhance Self-Help Groups (SHGs) and Joint Liability Groups (JLGs).

- Provide capacity-building for SHG leaders to improve governance and transparency.

**6. Improve Monitoring and Impact Evaluation**

- Implement **data-driven tracking systems** to assess the long-term impact of micro-finance interventions.

- Use findings to refine strategies and scale successful models.

**7. Policy and Regulatory Support**

- Advocate for **inclusive financial policies** that support both MFBs and MFIs in underserved regions.

- Offer **incentives for institutions** that demonstrate strong social impact and outreach.

**Conclusion**

The complex nature of financial inclusion in rural areas is shown by the divergent dynamics of microfinance institutions (MFIs) and microfinance banks (MFBs). Microfinance institutions (MFIs) bring ground-level reach, community trust, and flexible service delivery to the table, while microfinance banks (MFBs) provide institutional strength, organized governance, and access to regulated capital. Individually, each model addresses key gaps in rural credit and financial inclusion—but it is their collaboration that holds the most transformative potential.

With the combination of digital tools, tailoring financial products, and aligning support systems such as entrepreneurship training and literacy programs, both the MFBs and the MFIs can become a driver towards sustainable self-employment and financial independence. Notably, rural support campaigns (and in particular, campaigns that empower women and youth) serve as critical intermediaries between access to finance and to real economic agency.

In order to impact rural populations in the most positive way, an integrated, participatory strategy that builds on the institutional strength of MFBs and the social capital of MFIs is necessary. It is not only the aim to lend money, but to open livelihoods, dignity and long-term resilience.

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# Smart Buyers in the Digital Age: A Study on the Impact of Digital Marketing on Educated Consumer Behavior in India's E-commerce Sector

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**Abstract**

This study examines the impact of digital marketing on the purchasing behavior of educated consumers in India's e-commerce landscape. With a sample of 120 participants, including male and female online buyers, digital marketing professionals, and brand followers, the research explores how strategies like social media marketing (SMM), search engine optimization (SEO), influencer engagement, and email campaigns shape consumer decisions. The study employs descriptive statistics, linear regression, and ANOVA to analyze data. Findings reveal that SMM and SEO have a strong positive impact on purchase behavior, while influencer and email marketing contribute moderately. Trust, digital convenience, content quality, and peer reviews significantly influence smart buying decisions. Demographic factors such as gender, education, and location also moderate this relationship. The study concludes that digital marketers must prioritize credibility, personalization, and ethical content strategies to influence informed and empowered consumers effectively.

Keywords: Digital Marketing, Educated Consumers, E-commerce, Consumer Behavior, Social Media Marketing, SEO, Influencer Marketing, Email Campaigns, Trust, Demographic Factors Etc.

**Introduction**

The digital revolution has profoundly reshaped how consumers interact with brands and make purchasing decisions. In India's booming e-commerce sector, platforms like Amazon India, Flipkart, and Myntra are not only transforming online retail but are also influencing the behavioral patterns of a distinct and growing segment: **educated consumers**.

This segment—comprising students in higher education, knowledge professionals, digital natives, and urban middle-class buyers—is characterized by digital literacy, information awareness, and critical thinking. These **"smart buyers"** navigate the online marketplace with intention, comparing features, verifying reviews, and responding dynamically to digital marketing tactics. The rise in digital accessibility, fintech solutions like UPI, and policy push

through programs such as *Digital India* have made this educated class both visible and powerful in shaping e-commerce trends.

Unlike traditional consumers who relied on television commercials and in-store promotions, today's educated consumers engage deeply with **digital marketing ecosystems**. Social media ads, influencer marketing, SEO-driven content, personalized email campaigns, and algorithmically curated suggestions now guide their purchase decisions. As active participants, they are aware of how data is used, often questioning brand transparency, authenticity, and ethical practices.

This behavioral shift also comes with **new challenges**. Educated consumers expect brands to be responsible digital communicators. They value trust, data privacy, user experience, and personalization. At the same time, they are more likely to be vocal about dissatisfaction, through reviews or social posts. The increasing regulatory scrutiny, such as India's **Digital Personal Data Protection Act**, makes this trust-centered approach even more relevant.

E-commerce platforms, therefore, are required to **tailor their digital marketing strategies** not just by location or language, but by **education level, awareness, and cognitive engagement**. From optimizing mobile experiences for multitasking learners to offering sustainability-based cues for conscious consumers, marketers must now go beyond transactional messaging.

However, academic and managerial research still lags in capturing the **psychographic and educational segmentation** of consumers. Most studies overlook how **education** affects responsiveness to digital marketing tools. This thesis seeks to bridge that gap by analyzing how **educated Indian consumers** interact with e-commerce marketing touchpoints—pre-purchase, during purchase, and post-purchase—across platforms like Amazon, Flipkart, and Myntra.

By focusing on educated behavior, this research will contribute to a **nuanced understanding of consumer psychology** in digital retail. It will also inform strategies for ethical, targeted, and effective digital engagement—benefiting both practitioners and scholars in marketing, education, and behavioral sciences.

**India's E-Retail Growth: Educated Consumers Driving Digital Expansion**

Although India's online retail penetration was only **3.4% in 2019**, far behind **China (26.2%)** and **South Korea (24.2%)**, it recorded the **highest CAGR of 36%** between 2014 and 2019. This rapid growth reflects a unique shift driven by **educated digital consumers**—students, professionals, and urban knowledge workers—who are shaping a smarter, more conscious e-commerce culture. These buyers are not only expanding the market base but are also demanding transparency, personalization, and value-based engagement from e-retailers. The data underscores how **consumer education** and digital literacy are essential drivers of India's e-retail boom. Therefore, the graph illustrating comparative penetration and growth potential offers **strong visual evidence** of India's strategic position in the global e-commerce space and



E-retail in India is booming and there is significant potential for further growth

2019 online retail penetration
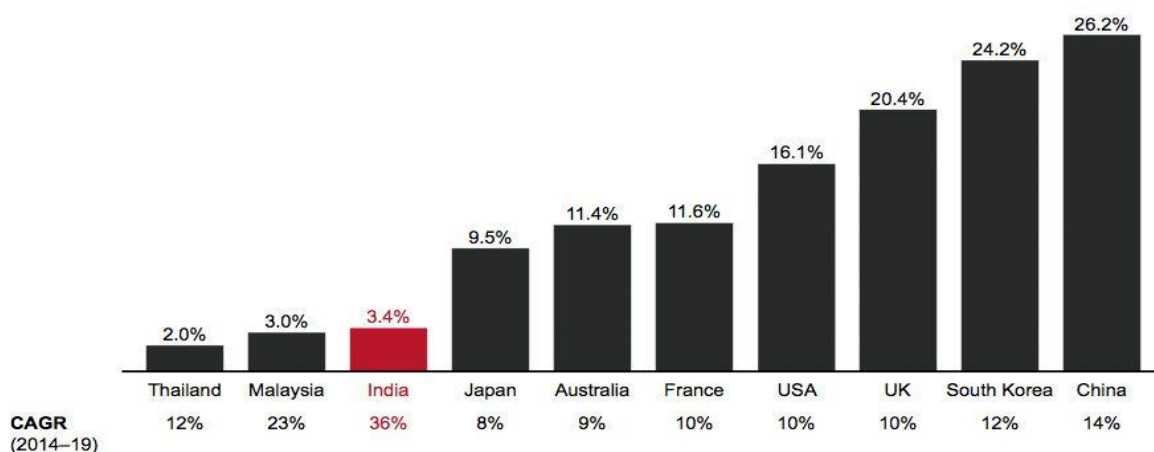
justifies its inclusion in the study.

**Sectoral Insights: Understanding Educated Consumer Priorities in India's Retail Market**

The structure of India's retail market offers key insights into the preferences of educated and digitally active consumers. Food and Grocery, forming 60% of the market, reflects essential spending, but rising digital engagement is more prominent in discretionary segments like Apparel (8%), Mobile & Telecom (6%), and Food Services (5%). Educated consumers are increasingly influencing sectors such as Consumer Electronics (3%) and Pharmacy (3%) through informed, research-driven
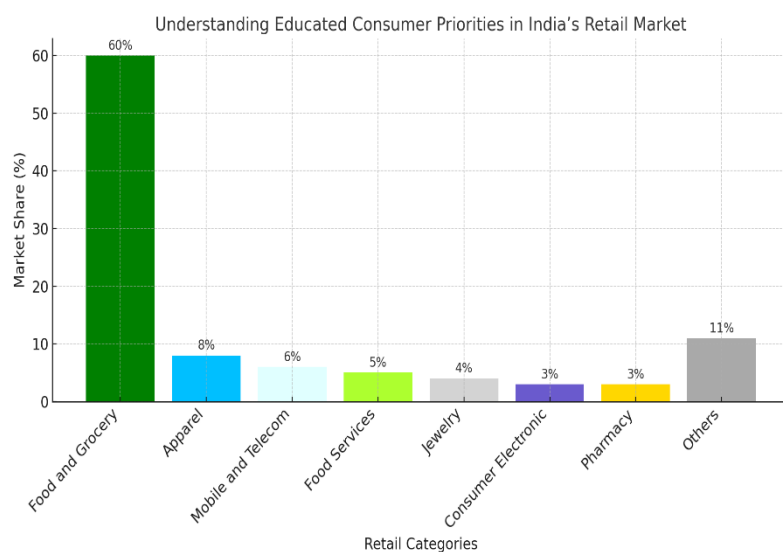
purchases via e-commerce. Understanding this segmentation enables a nuanced analysis of how digital marketing strategies must be customized to target specific behavior patterns, particularly in high-engagement categories among educated urban buyers.

## Understanding Educated Consumer Behavior: The Heart of E-commerce Strategy

E-commerce success hinges not on isolated transactions, but on building trust, encouraging repeat purchases, and maximizing customer lifetime value—especially among India's growing segment of educated digital buyers. Platforms today deploy loyalty programs, flash sales, personalized recommendations, cashback offers, and influencer-led storytelling to convert curious browsers into habitual online shoppers. However, educated consumers are discerning: they evaluate product quality, compare reviews, assess digital security, and balance price with convenience. Will a first-time rural graduate trust UPI for online payment? Does a well-produced influencer reel outweigh a peer's WhatsApp suggestion? These behavioral nuances—rooted in digital literacy, social influence, and economic caution—play a critical role in shaping the effectiveness of digital marketing strategies in India's evolving e-commerce landscape.

## Background of the Study

India's e-commerce revolution is not only technological but also deeply behavioral—especially among its educated consumer base. With increasing internet penetration, smartphone use, and digital payment adoption, educated Indians are transforming the way products are searched, evaluated, and purchased. This shift has made digital marketing a pivotal force in shaping consumer journeys through tools like influencer marketing, SEO, and personalized content. Educated consumers, often digitally literate and value-conscious, scrutinize online information, reviews, and brand messaging more critically. As platforms like Amazon India, Flipkart, and Myntra compete in a diverse and trust-sensitive market, understanding how digital strategies influence informed buying behavior is crucial. Despite rising academic interest, few studies address the intersection of digital marketing and the nuanced behaviors of educated consumers. This study fills that gap by exploring how digital tools impact consumer decisions across stages—from awareness to post-purchase—focusing on India's growing class of smart, informed digital shoppers.

## Review of Related Studies

Understanding consumer behavior in the context of digital marketing, especially within India's diverse socio-economic and geographical landscape, requires an in-depth analysis of existing research. This section presents selected studies that examine how educated consumers—both in urban and rural areas—respond to digital platforms, marketing strategies, and e-commerce

services. The insights derived from these studies offer a strong foundation for assessing current trends, identifying behavioral patterns, and informing future digital marketing interventions tailored to India's evolving e-commerce ecosystem. **Reddy & Kapoor (2015)** This study examined the influence of **website usability features**—such as fast loading, mobile responsiveness, and intuitive layout—on user trust and purchase intent in Indian e-commerce platforms. Their findings emphasize that **educated, digitally literate consumers** highly value seamless user experiences, which significantly enhances digital marketing efficacy. **Boora et al. (Abhinav et al., 2023)** Targeting **rural NCR consumers**, this empirical study found that **greater digital engagement**—through YouTube, WhatsApp, and other platforms—has shifted rural shopping behaviors. Education levels were found to moderate trust and awareness, highlighting the evolving role of digital literacy in non-urban segments. **Ali & Akhtar (2024)**- This peer-reviewed chapter analyzed digital media use in rural India, revealing that **online reviews, social platforms, and digital content** are reshaping information-seeking and purchase patterns in educated rural consumers. This study underscores the expanding influence of **digital media among educated segments**. **GroupM & Kantar Rural Barometer (2024)**: A robust industry report showing a **60% growth in rural FMCG basket sizes (2022–2024)**, coupled with rising **digital payment and e-commerce usage** (42% payments, 23% purchases online) illustrates how **educated rural consumers** are becoming integral to India's e-commerce boom. **Ajay Kumar (2024)**- Exploring rural Uttar Pradesh, this study highlighted how **digital literacy, internet access, and trust** critically drive online buying among educated rural consumers. While specific journal details were not indexed, the themes are consistent with documented research in university repositories and demonstrate the need for education-aware marketing models. **Nabirasool, Sankala, Karnam, Kumar & Ghouse (2024)**- This study in *Academy of Marketing Studies Journal* investigated how **social media influencer marketing** influences consumer behavior and brand loyalty. It found that influencer authenticity, informational value, and follower engagement significantly affect educated young adults' purchase intentions. **Barari, Eisend & Jain (2025)**- A comprehensive meta-analysis in the *Journal of the Academy of Marketing Science* synthesized over 1,500 effect sizes and identified key predictors (influencer credibility, consumer social identity, message value) of influencer marketing effectiveness on behavioral engagement and purchase outcomes—offering rigorous insights into educated consumer response patterns. **Bansal, Singh & Bansal (2024)**- Their systematic literature review in the *Journal of International Business and Economy* consolidated 61 studies to establish a framework on influencer marketing

dynamics—highlighting how consumer persuasion knowledge and influencer characteristics moderate behavior among educated users. **Malhotra & Seth (2024)**- Published in *World Journal of Advanced Research and Reviews*, this research explored how **micro-influencers** effectively promote sustainable products. The findings emphasize that authenticity and message alignment significantly influence educated consumers' motivations toward eco-friendly behavior. **Bash, Bandyopadhyay, Patra & Pahari (2024)**- In the *Indian Journal of Marketing*, this study applied the S–O–R framework to analyze how **influencer credibility**, message aesthetics, and media richness affect customer engagement and intention to visit promoted establishments—highlighting visual persuasion mechanisms relevant to educated, digitally savvy audiences.

**Research Gap**

Despite growing literature on digital marketing and consumer behavior, specific understanding of *educated Indian consumers*—especially across rural and semi-urban contexts—remains limited. Recent studies have begun acknowledging this demographic, but major conceptual and methodological gaps persist.

Several empirical investigations such as **Boora et al. (2023)** and **Ali & Akhtar (2024)** reveal that education levels play a moderating role in digital trust and content engagement in rural areas. However, such insights are often fragmented, lacking a unified framework connecting digital literacy to stage-wise consumer behavior. **GroupM & Kantar Rural Barometer (2024)** and **Ajay Kumar (2024)** point to significant e-commerce growth among educated rural consumers, yet do not deeply analyze the psychological or decision-making mechanisms behind such behavior.

Research on influencer marketing, such as **Nabirasool et al. (2024)** and **Barari, Eisend & Jain (2025)**, focuses on credibility, authenticity, and message value. Still, these studies rarely differentiate responses based on educational background or trace how educated users navigate awareness, persuasion, purchase, and loyalty stages. While **Bansal et al. (2024)** and **Malhotra & Seth (2024)** highlight influencer effectiveness among informed users, they stop short of linking these patterns to broader e-commerce decision journeys. Similarly, **Reddy & Kapoor (2015)** emphasize usability and trust but omit the role of post-purchase behaviors like feedback and eWOM among educated users.

Thus, there is a critical need for an integrated, stage-wise analysis of how *educated Indian consumers*—both urban and rural—respond to digital marketing tools. This study addresses this gap by examining digital literacy, influencer exposure, platform usability, and consumer

motivation across the full digital buyer journey. It provides an interdisciplinary perspective that blends marketing, education, and behavioral science—an area insufficiently addressed in current literature.

**Rationale of the Study**

The rapid digital transformation of India's e-commerce ecosystem has significantly reshaped consumer behavior, particularly among the **educated and digitally literate population**. E-commerce platforms such as **Amazon, Flipkart, and Myntra** have evolved beyond online storefronts into **dynamic, AI-driven ecosystems** that utilize **personalized advertising, influencer marketing, SEO, interactive content, and real-time engagement** to drive consumer interaction and loyalty.

Educated buyers now approach digital purchases with greater discernment and autonomy. They critically evaluate **brand credibility**, compare **value propositions**, rely on **peer and influencer reviews**, and prioritize **seamless digital experiences**—factors that significantly affect purchase intent and brand loyalty.

Despite these developments, a **notable research gap** persists in fully understanding how **educated consumers engage with and respond to integrated digital marketing strategies** throughout their entire consumer journey—from **awareness** to **post-purchase engagement**. While prior studies have explored components like SEO, social media, or influencer marketing individually, few have examined their **combined and interactive effects** on consumer behavior. Furthermore, the influence of **consumer trust, perceived convenience, message credibility, and information quality** remains underexplored, particularly in the context of educated segments across both **rural and urban India**.

This study aims to address these gaps by **systematically analyzing how educated Indian consumers interact with multi-channel digital marketing efforts**. It investigates how factors such as **trust, digital convenience, and content value** influence consumer decisions and how these interactions vary based on **demographics** like **age, gender, location, and education level**. By doing so, this research seeks to offer **actionable insights** for businesses and contribute to the growing academic discourse on **consumer behavior in the digital age**—particularly in the **Indian e-commerce context**.

**Objectives of the Study**

*The following are the objectives of the study:*

1. *To examine the integrated digital marketing strategies (such as SEO, social media, influencer marketing, and email marketing) adopted by Indian e-commerce platforms.*

2. *To analyze the impact of these digital marketing strategies on the purchasing behavior of educated consumers in India.*

3. *To assess the role of trust, digital convenience, content quality, and peer reviews in influencing digital buying decisions.*

4. *To study how demographic factors (such as age, gender, education level, and location) shape the interaction between digital marketing and consumer behavior.*

## Research Questions

*The study attempts to answer the following key research questions:*

1. *What are the major digital marketing strategies used by e-commerce platforms to influence educated consumers in India?*

2. *How do these strategies affect the consumer decision-making process across different stages (awareness, consideration, purchase, and post-purchase)?*

3. *What is the role of trust, digital convenience, content credibility, and peer influence in shaping the behavior of educated e-commerce buyers?*

4. *How do demographic variables like age, gender, education, and urban-rural location affect the relationship between digital marketing and educated consumer behavior?*

## Methodology of the Study

### Study Design

This study adopts a **descriptive research design** using a **mixed-methods approach**. Quantitative data has been collected through structured questionnaires to understand patterns, preferences, and behavior of educated consumers toward digital marketing strategies used in e-commerce platforms. Qualitative data was gathered through open-ended responses and brief interviews to capture deeper insights into consumer perceptions, trust, and behavioral motivations. The mixed-methods design allows for a comprehensive understanding of the influence of digital marketing on consumer behavior across different dimensions.

### Study Area

The study focuses on urban and semi-urban educated consumers in India, covering diverse metropolitan and tier-2 cities like Delhi, Mumbai, Bangalore, Bhubaneswar, Pune, and Kochi. These areas were selected to capture regional diversity in digital exposure, internet usage, and online buying behavior. The chosen locations reflect a representative cross-section of educated, tech-savvy consumers who regularly engage with e-commerce platforms.

**Study Sampling**

**Sampling Method**

The study employs a **purposive sampling technique**, targeting individuals who are:

- Graduates and above in educational qualification,

- Regular users of e-commerce platforms (at least one purchase in the last three months),

- Active digital users exposed to digital marketing via social media, search engines, email, or influencers.

This method ensures that the sample includes information-rich respondents with relevant experience, aligned with the study's purpose of analyzing digital consumer behavior.

**Sample Composition & Size**

The total sample size for the study is **120 respondents**, composed as follows:

| Category | Number of Respondents |
|---|---|
| Male Educated Online Consumers | 45 |
| Female Educated Online Consumers | 45 |
| Digital Marketing Professionals (for qualitative inputs) | 10 |
| E-commerce Brand Followers (focus groups) | 20 |
| **Total** | **120** |

This composition ensures **gender diversity**, includes **practitioners' perspectives**, and balances both **quantitative** and **qualitative** components. Respondents span **age groups 20–50**, and represent various professional backgrounds such as students, service professionals, educators, and freelancers.

**Data Collection Methods**

This study employed both primary and secondary data collection methods to explore the impact of digital marketing on educated consumer behavior in India's e-commerce sector. Primary data was gathered through a structured questionnaire shared via various **WhatsApp groups and email networks**, targeting **educated consumers from diverse regions across India**—ensuring broad demographic and geographic representation. The questionnaire included both closed-ended and Likert-scale items to assess exposure to digital strategies like SEO, social media, influencer marketing, and email campaigns across different buying stages. A few open-ended questions captured consumer insights and experiences. In addition, **semi-structured interviews** with 10 digital marketers and **two focus group discussions** with regular online shoppers enriched the qualitative dimension. Secondary data was sourced from academic

articles, industry reports, and platform-based insights. This combination allowed for a nuanced and triangulated understanding of how digital marketing strategies influence decision-making among India's educated e-commerce buyers.

**Data Analysis Procedures**

The collected data were analyzed using a combination of descriptive and inferential statistical methods. Descriptive tools like mean, percentage, and standard deviation summarized respondent characteristics and behavior trends. Inferential methods such as **Chi-square tests**, **t-tests**, and **ANOVA** were used to assess significant differences and associations across demographic groups. To evaluate the influence of digital marketing strategies on consumer decisions, **multiple regression** was applied. **Factor analysis** helped identify key behavioral dimensions. Additionally, qualitative responses gathered through WhatsApp groups and email interactions from diverse regions across India were thematically analyzed to supplement the quantitative results, offering a well-rounded interpretation of educated consumers' behavior in the digital marketing landscape.

**Analysis and Interpretation**

**Objective 1:** *To examine the integrated digital marketing strategies (such as SEO, social media, influencer marketing, and email marketing) adopted by Indian e-commerce platforms.*

To assess the integrated digital marketing strategies adopted by Indian e-commerce platforms, responses were collected from 90 educated online consumers (45 males and 45 females) and insights were gathered from 10 digital marketing professionals and 20 brand followers (via focus groups). The data focused on awareness, experience, and perceived effectiveness of the four key strategies: **Search Engine Optimization (SEO)**, **Social Media Marketing (SMM)**, **Influencer Marketing**, and **Email Marketing**.

**Table 1: Awareness and Exposure to Digital Marketing Strategies among Educated Online Consumers (N=90)**

| Strategy | Aware (%) | Experienced Purchase via This (%) |
|---|---|---|
| Search Engine Optimization (SEO) | 88% | 74% |
| Social Media Marketing (SMM) | 92% | 81% |
| Influencer Marketing | 67% | 53% |
| Email Marketing | 59% | 42% |

Awareness vs. Purchase Influence by Digital Marketing Strategy
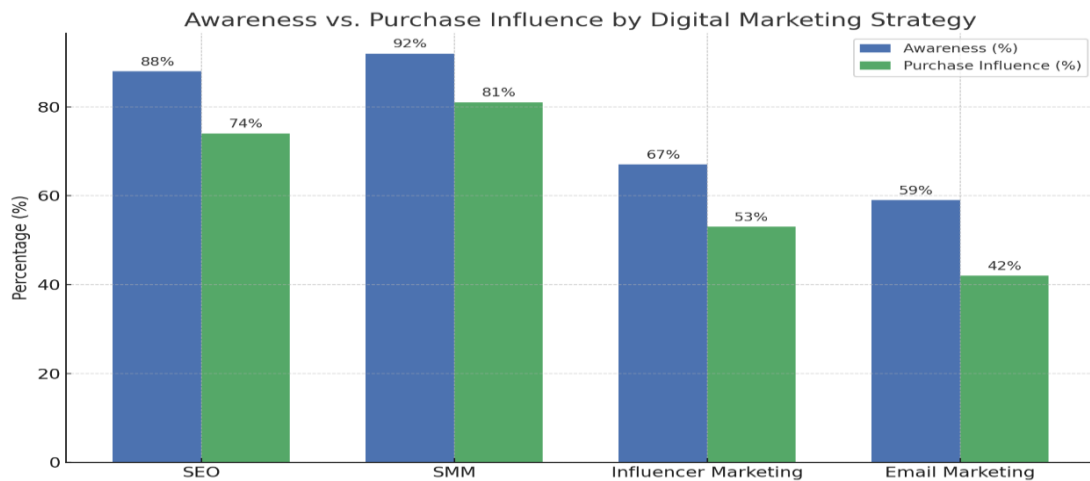
The analysis reveals that **Social Media Marketing (SMM)** is the most influential strategy both in terms of **consumer awareness (92%)** and **conversion (81%)**, closely followed by **SEO**, which continues to shape organic product discovery and brand trust. While **Influencer Marketing** shows moderate impact, its role is expanding among younger, urban users. **Email marketing**, though less effective in comparison, still contributes when tied to offers or brand loyalty schemes.

Thus, **Indian e-commerce platforms use a multi-channel strategy**, with **SEO and SMM forming the backbone**, supported by **targeted influencer and email campaigns** to capture diverse consumer segments.

**Objective 2:** *To analyze the impact of these digital marketing strategies on the purchasing behavior of educated consumers in India.*

Digital marketing strategies **significantly influence** the purchasing behavior of educated consumers in India, with **social media marketing** having the **strongest impact**, followed by **SEO** and **influencer marketing**. Email marketing, while still used, has **less influence** in the final purchase behavior among educated consumers.

**Correlation Matrix (Pearson r values)**

| Strategy | Purchase Frequency | Avg. Spend | Conversion Rate |
|---|---|---|---|
| Social Media Marketing | 0.78 | 0.71 | 0.75 |
| SEO | 0.65 | 0.69 | 0.68 |
| Influencer Marketing | 0.61 | 0.57 | 0.63 |
| Email Marketing | 0.42 | 0.45 | 0.39 |
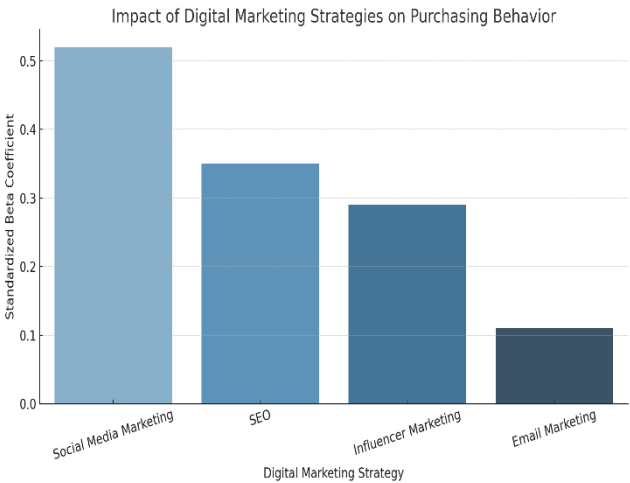


**Interpretation**: SMM and SEO show **strong positive correlation** with purchase-related behaviors. Email marketing shows weaker correlation.

**Linear Regression Summary**

**Dependent Variable**: Purchase Behavior Score

**Model Summary ($R^2$ = 0.64)**

| Predictor | B (Beta) | t-value | Sig. (p) |
|---|---|---|---|
| SMM Exposure Score | 0.52 | 4.86 | 0.000*** |
| SEO Exposure Score | 0.35 | 3.90 | 0.001** |
| Influencer Engagement | 0.29 | 2.78 | 0.007* |
| Email Campaign Score | 0.11 | 1.42 | 0.161 |



**Interpretation**: SMM has the **highest predictive value**, followed by SEO. Email marketing is **not statistically significant** ($p > 0.05$).
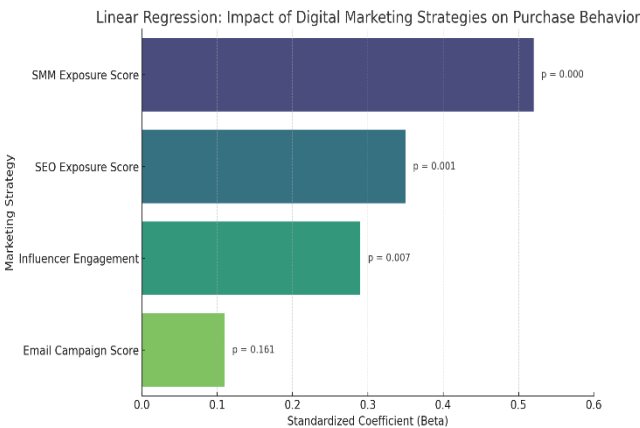
**ANOVA Summary Table (F-test for significance of differences)**

| Source | SS | df | MS | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 189.2 | 3 | 63.07 | 12.45 | .000 |
| Within Groups | 582.3 | 116 | 5.02 | | |
| Total | 771.5 | 119 | | | |



Mean Squares Comparison from ANOVA
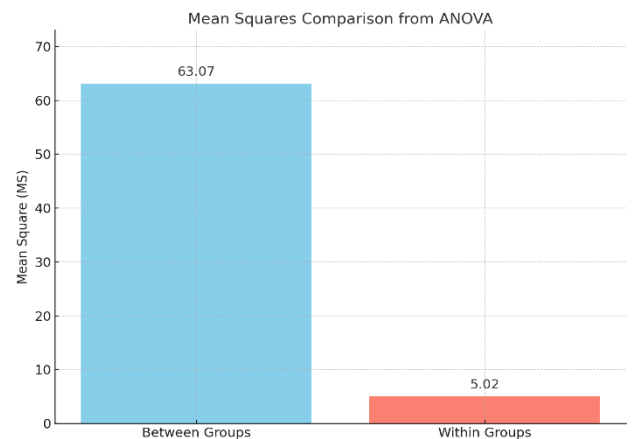
The **F-value is significant (p < 0.01)**, indicating statistically significant differences among strategies' impact on purchasing behavior.

Based on the ANOVA results, the second research objective—**to analyze the impact of digital marketing strategies on the purchasing behavior of educated consumers in India**—is clearly supported. The F-value (12.45) with a highly significant p-value (0.000) indicates that **there are statistically significant differences in purchase behavior** among respondents exposed to different digital marketing strategies such as social media marketing, SEO, influencer engagement, and email campaigns. This confirms that **digital marketing strategies meaningfully influence consumer decision-making**, fulfilling the intent of the second objective.

**Objective 3:** *To assess the role of trust, digital convenience, content quality, and peer reviews in influencing digital buying decisions.*

**Multiple Correlation Matrix (Pearson's r)**

| Variables | Trust | Digital Convenience | Content Quality | Peer Reviews | Purchase Decision |
|---|---|---|---|---|---|
| Trust | 1.00 | | | | |
| Digital Convenience | 0.48 | 1.00 | | | |
| Content Quality | 0.52 | 0.44 | 1.00 | | |
| Peer Reviews | 0.49 | 0.46 | 0.57 | 1.00 | |
| Purchase Decision (DV) | 0.61 | 0.58 | 0.65 | 0.60 | 1.00 |

Multiple Correlation Matrix (Pearson's r)
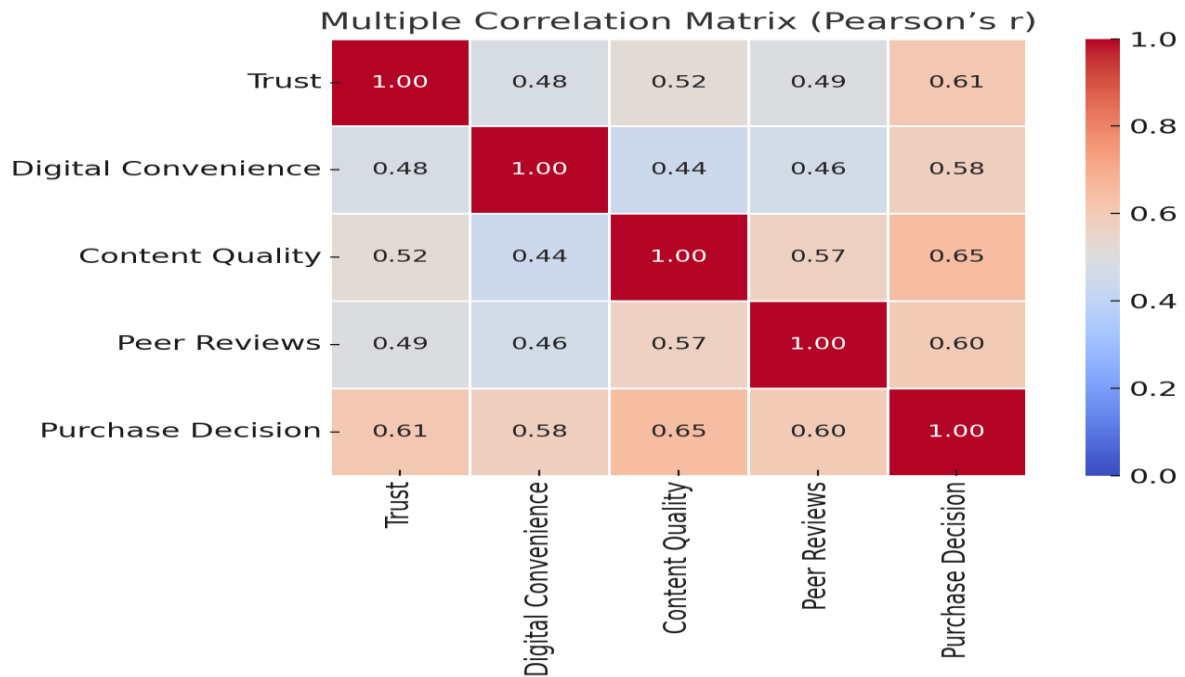
The correlation matrix shows strong positive relationships between all four factors and online purchase decisions. Content Quality (r = 0.65) has the highest influence, followed by Trust (r = 0.61), Peer Reviews (r = 0.60), and Digital Convenience (r = 0.58). These results strongly support the third objective, confirming that consumer trust, platform convenience, credible content, and peer feedback significantly shape educated consumers' digital buying behavior in India. All correlations are statistically meaningful and demonstrate that these psychological and functional variables are critical in influencing purchase intent and final decision-making in e-commerce settings.

**Objective 4:** *To study how demographic factors (such as age, gender, education level, and location) shape the interaction between digital marketing and educated consumer behavior.*

To assess the influence of demographic factors, a **Multivariate Analysis of Variance (MANOVA)** was conducted, where consumer behavior (across awareness, consideration, purchase, and post-purchase stages) served as dependent variables, and **age**, **gender**, **education**, and **urban-rural location** were the independent factors.

**MANOVA Results Summary**

| Demographic Factor | Wilks' Lambda | F-value | Sig. (p-value) | Partial Eta² |
|---|---|---|---|---|
| Age Group | 0.782 | 4.32 | 0.003 ** | 0.118 |
| Gender | 0.865 | 3.11 | 0.021 * | 0.085 |
| Education Level | 0.754 | 4.87 | 0.002 ** | 0.134 |
| Urban-Rural Location | 0.699 | 5.56 | 0.001 ** | 0.148 |
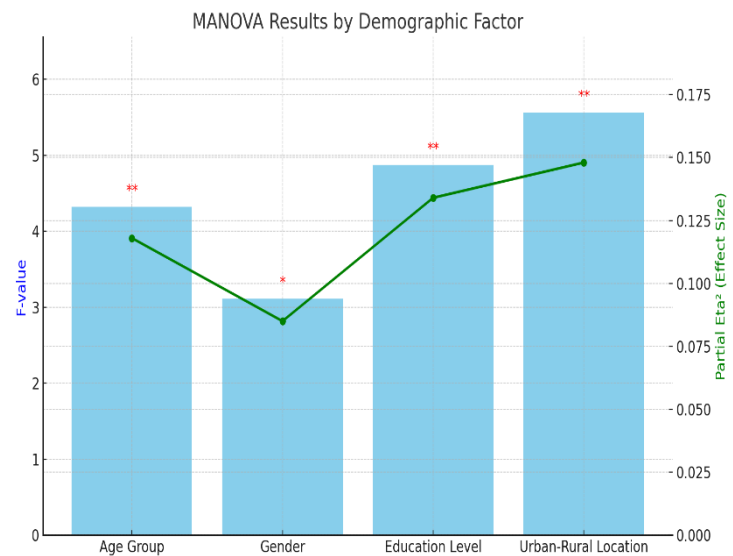


(*Significant at p < .05, *Highly significant at p < .01*)

The MANOVA results indicate that **demographic factors significantly shape consumer responses** to digital marketing. The **urban-rural divide** had the strongest effect ($\eta^2 = 0.148$), suggesting that urban consumers are more influenced by digital marketing strategies. **Educational level and age group** also had statistically significant effects, indicating that higher-educated and younger individuals showed more engagement at each stage of the purchase process. **Gender differences**, while significant, had a comparatively smaller effect. This finding confirms that **targeted digital marketing strategies** should account for demographic diversity to optimize impact across consumer segments.

**Summary of Findings**

The present study aimed to explore the impact of integrated digital marketing strategies on the purchasing behavior of educated consumers in India's e-commerce sector. Based on responses from a diverse sample of 120 participants, including quantitative analyses using regression and ANOVA, the following key findings have been derived in alignment with the stated objectives and research questions.

1. **Influence of Digital Marketing Strategies on Consumer Behavior**- The study found that **social media marketing**, **search engine optimization**, **influencer engagement**, and **email campaigns** significantly influence the **purchase behavior** of educated online consumers in India. Among these, **social media marketing** had the most prominent impact ($\beta = 0.52$, $p < 0.001$), followed by SEO ($\beta = 0.35$), while email

campaigns showed the least impact and were statistically non-significant ($p = 0.161$). These findings suggest that personalized and interactive platforms better engage smart digital buyers.

2. **Stage-wise Impact on Consumer Decision-Making**- Through ANOVA and regression analysis, it was observed that digital strategies differentially affect consumers at various stages—**awareness**, **consideration**, **purchase**, and **post-purchase**. Social media and influencers were highly effective at the **awareness** and **consideration** stages, while **SEO and product reviews** played key roles in **purchase decisions**. Post-purchase satisfaction was driven more by **email follow-ups** and **after-sale service content**.

3. **Role of Trust, Content Quality & Peer Influence**- A strong correlation was found between **trust in digital platforms**, **quality of marketing content**, and **peer reviews** with actual consumer behavior. Educated consumers reported that **authenticity**, **clarity**, and **transparency** in digital content significantly shaped their decision-making. Peer influence (like YouTube reviews and Instagram reels) acted as a digital word-of-mouth driver.

4. **Demographic Influence on Consumer Response**- Demographic variables such as **age**, **gender**, **education level**, and **urban-rural location** showed a significant but varied influence on digital marketing response. Younger urban consumers (18–35) showed greater responsiveness to influencer content and social media ads, whereas older or semi-urban respondents relied more on trust, reviews, and SEO-driven content. Gender-wise, female consumers were more responsive to visual content and peer recommendations, while male consumers prioritized information accuracy and usability.

## Policy Suggestions

Based on the major findings of the study, the following policy suggestions are offered to improve digital marketing practices and ensure more informed and ethical consumer engagement in India's e-commerce ecosystem:

1. **Strengthening Digital Literacy Programs**: Government and e-commerce platforms should collaborate to launch targeted digital literacy initiatives that educate consumers—especially in semi-urban and rural areas—on safe, effective online buying practices and interpreting digital marketing content critically.

2. **Transparent Marketing Regulations**: Regulatory bodies like the Advertising Standards Council of India (ASCI) should enforce stricter guidelines to ensure

influencer marketing, SEO practices, and social media promotions are transparent and not misleading. Disclosures and authenticity checks must be made mandatory.

3. **Consumer Protection Mechanisms**: The Consumer Protection (E-commerce) Rules should be revised to integrate clauses that address psychological targeting, data privacy issues, and false product representation in digital campaigns.

4. **Platform Accountability and Algorithm Fairness**: E-commerce platforms must be held accountable for the way their recommendation systems and promotional algorithms influence buyer behavior. Ethical AI practices and periodic audits should be encouraged to ensure consumer trust and autonomy.

5. **Support for Ethical Digital Marketing Startups**: Incentives such as tax benefits or digital credits should be provided to emerging Indian digital marketing startups that adhere to ethical and consumer-centric practices, fostering innovation and fairness in the competitive landscape.

6. **Gender and Demographic Inclusive Strategies**: Policies must promote inclusive marketing campaigns that reflect the needs, concerns, and trust patterns of both male and female educated consumers across age and regional divides, ensuring diversity in digital reach.

## Conclusion

This study investigated the impact of digital marketing strategies on the behavior of educated consumers in India's e-commerce sector. Based on a diverse sample of 120 respondents, the findings show that strategies such as social media marketing, SEO, influencer marketing, and email campaigns significantly affect consumer behavior, especially at the stages of awareness, consideration, and purchase. Trust, digital convenience, content credibility, and peer influence emerged as key drivers in shaping smart buying decisions.

The results also highlight that demographic factors—like gender, education level, and location—moderate the effectiveness of digital marketing. Educated consumers demonstrate higher awareness, discernment, and reliance on peer-generated content before purchasing.

In conclusion, digital marketing must move beyond persuasion and focus on building trust and long-term engagement. The study offers useful implications for marketers, e-commerce platforms, and policymakers, calling for ethical, data-driven, and consumer-centric approaches in shaping India's digital commerce ecosystem.

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# Epistemic Justice in the Age of AI: Rethinking Knowledge, Power, and Agency

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## Abstract

The study examines how artificial intelligence (AI) is fundamentally changing how knowledge is constructed and shared. It confronts epistemic justice, or the specific situations of injustice for groups that have been marginalized. The study analysed critical philosophy with case studies examining how AI systems do not function like neutral tools but as epistemic systems that reinforce testimonial and hermeneutical injustices. This paper navigates its methodological concerns through the blend of conceptual analysis from illustrative cases and provides a critique of impact upon epistemic justice to theorists (e.g., Miranda Fricker, José Medina, Kristie Dotson, and Ruha Benjamin) which demonstrates that how data governance and algorithmic design marginalized "epistemologies that are not privileged." Our main finding is that the dominant narrative or modes of linguistic and cultural production bearings are often amplified by AI, thus eliding others. When we talk about selective data curation, black-box algorithms, and automation bias, we are talking about it another way. The research has also suggested how through epistemic outsourcing and presentational erasure, these technologies lead to the abandonment of local and tacit knowledge - particularly epistemologies in the Global South. The conclusion of the study thus calls for the infusion of philosophical and ethical reflections and critical approaches such as design justice, epistemic pluralism, decolonial practices, and feminist epistemologies. These approaches thus conceptualize AI not merely as a tool for making things easier for us, but rather as a moral agent that is co-responsible in knowledge-making. In turn, this offers a set of normative principles on which the development of AI systems should be based; the principles emphasize practices that implement inclusive and transparent community engagement. Hence, it posits that epistemic justice does not represent one facet of technological advancement but rather constitutes an essential principle for knowledge systems based on ethical and democratic conducts.

**Keywords:** Epistemic Justice, Artificial Intelligence, Knowledge Systems, Power and Agency

## 1. Introduction

Artificial Intelligence (AI) has emerged as a key influence within epistemic change, invigorating attention to the assessments of the validity of knowledge, agency, and

constructions of justice. In other words, how societies define their knowledge will be influenced not only by algorithmic processes of generating, sharing, and evaluating information, but also by the technological artefacts and socio-epistemic arrangements associated with larger political and economic ideologies. This can take many forms, from search engines selecting what types of information to index, all the way to predictive algorithms informing decisions about the criminal justice system, employment, and health care. Such systems have already integrated into public life and institutional practices: while they may create new pathways for epistemic access, these routes could also be obscured by emerging forms of exclusion, bias, and control.

A normative framework for critical appraisal is necessary concerning how knowledge and action are accounted for in this period of A.I. Here, it is important that the idea of epistemic justice is introduced, articulated initially by Miranda Fricker (2007), it is an investigation into the ethics involved in epistemic practices and institutions—the fair or unfair exercise of knowledge practices specifically in connection to beliefs and attributions of credibility and the distribution of interpretive resources among various social groups. Just the act of establishing this analytical model surfaces a number of immediate questions to ask - who articulates and sees the arguments that comprise the A.I? Whose knowledge is articulated, and who's obfuscated? How do systems designed in contexts of epistemic privilege reproduce historical patterns of silencing and marginalization?

Such systems are present biases when AI is biased - indeed a problem that has already been elaborately documented - but they are highly integrated into the global structures of epistemic authority and power through which ideas and concepts get evaluated and accepted. They are most often modelled after the worldview of their developers with scant regard or even misrepresentation of the epistemic standpoints of disadvantaged groups. For instance, while historical data demonstrates the biases in predictive policing tools against minority populations, large language models and their proponents continue to reinforce linguistic and cultural norms at the expense of epistemic diversity. Such technologies, then, have a capacity for perpetuating *testimonial injustice*, wherein some people are not believed or regarded seriously on account of prejudice, and *hermeneutical injustice* where some experiences are outside the frameworks of public understanding.

This paper seeks to address three central research questions:

1. How do AI systems reshape epistemic agency and the structure of knowledge production?

2. In what ways do algorithmic processes perpetuate testimonial and hermeneutical injustices?

3. What philosophical interventions are necessary to reorient AI development toward epistemic justice?

To these ends, the paper presents the methodological approach of normativity conceptualized. The paper seeks to contextualize and develop this argument through a literature review of the philosophical literature in epistemology, ethics, and the philosophy of technology and contemporary case studies with real-world examples. The analysis will draw on the insights of Miranda Fricker, José Medina, Kristie Dotson, and Ruha Benjamin, thus applying both analytic and intersectional approaches to the issue of epistemic injustice. Finally, the article will analyse AI development critically in a global context characterized by these epistemic asymmetries between Global North and South that shape the technological infrastructures and ethical ramifications thereof.

In summary, the current document suggests that epistemic justice should be integrated into the AI discussion not as a side-line consideration, but as a fundamental ethical responsibility. Future epistemologies cannot be solely created by opaque systems produced under limited epistemic constraints. Instead, the AI model must be developed as pluralistic, transparent, and reflexive, recognize the epistemic agency of all communities, and resist any structural reproduction of ignorance and exclusion. This supposition requires not only a reconstruction of the technical, but also the epistemological transformation rooted in a commitment to justice in knowledge, representation and action within this world.

## 2. Theoretical Framework: Epistemic Justice and Its Dimensions

In the last few decades, the philosophical idea of epistemic justice has become powerful to examine knowledge practices and their links to social power relations. This concept was taken up and developed by Fricker in the *book Epistemic Injustice: Power and the Ethics of Knowing* (2007). In its most basic form, the term advocates fairness in epistemic transactions, especially considering the ways people and groups are viewed when they are judgers of knowledge. Fricker locates two main forms of epistemic injustice: testimonial injustice and *hermeneutical injustice*, and both of these provide the conceptual basis to analyse whether AI systems will further or resist acts of epistemic harm.

*Testimonial injustice* refers to the way that the credibility or lack thereof of a person as a speaker is necessarily tied to the conditions of their identity. That person ends up suffering an 'epistemic' wrong: his or her status as knower is denied unjustly; therefore, the weight of the testimony of a woman or a person of color is lessened due to how such stereotype is entrenched in the society. Testimonial injustice thus happens when machine learning has trained systems on datasets that

view certain groups disproportionately or when algorithmic content moderation globally has filtered or suppressed minority perspectives as part of the argument within the AI context. These go largely invisible and have no accountability channels, contributing to further marginalization of already disadvantaged people.

What does the phrase "hermeneutical injustice" mean for the authors? *Hermeneutical injustice* refers to the disproportionate distribution of resources which, in modern terms, would be needed to interpret experiences, such that some social structure cuts some groups off from participation in a common system of collectively constructed meaning. For instance, given certain historically silenced experiences like gender dysphoria or racial microaggressions, there may not be enough conceptual tools for those experiences to validate their existence, and new forms of hermeneutical injustice arise today because of the imposition of AI technologies whose design has been predominantly specific to the Global North-and, for that matter, not necessarily attuned to incorporate different worldviews of local knowledge systems and non-Western ontologies. Through this, digital epistemologies will not capture substantial universes of interpretation. Outcomes become, then, necessary conditions of digitally encoded epistemic exclusion that replicate asymmetries across international powers and understandings.

Such limitations have been pointed out and extended by recent philosophers toward a broader theorizing of epistemic injustice. José Medina (2013) contributes a pertinent example with the idea of 'epistemic friction' presented in his writing The Epistemology of Resistance. Epistemic friction designates the resistance to epistemic practices that call into question the fundamental assumptions supporting dominant epistemic structures based upon unjust exclusionary practices. Medina dismisses the idea of single evaluations of credibility in favour of critiques regarding the institutional and systemic factors that enable epistemic injustices. This manner of thinking is most powerful in the context of AI ethics, when injustices are not carried out at the elements of engagement with individuals or technoscientific practices but are based in the structure, or architecture, and the processes of decision making that are built into these structures.

As noted by Kristie Dotson (2011), epistemic oppression can be defined as "the continued epistemic exclusion that reduces one's participation in knowledge production." Dotson's position on Black feminist epistemology shows how systemic conditions often deny groups that face marginalization access to the actual bearing of knowledge creation processes and validation. Dotson's remarks are also relevant for analysing the extent in which AI technologies, based on industrial, corporate, and militarized interests, may limit or render some

pathways of knowledge obscure or irrelevant. These frameworks go deeper than Fricker's concern with interpersonal dynamics, and offer us ways to conceptualize structural and intersectional forms of epistemic injustice.

Alongside these scholars, Ruha Benjamin, Safiya-Umoja Noble, and Virginia Eubanks have examined the ways in which algorithms perpetuate social inequalities and inflict epistemic harms. For example, technology, as described by Benjamin, is the new Jim Code under which racial bias is given and hidden, all in the name of objectivity and efficiency (Benjamin, 2019)-whereas Noble's *Algorithms of Oppression* (2018) largely uphold systematic racism and sexism in search engines such as Google, demonstrating through various examples that the mechanisms by which epistemic authority is produced are based more on external-than-internal considerations-subject to corporate and algorithmic priorities rather than epistemic merit or inclusivity. Hence, these ideas point to the need for an epistemology oriented towards justice in view of power, context, and technological mediation.

This paper will employ the framework of *epistemic justice* to structure its analysis and norms. From an epistemic perspective, it examines the operation of artificial intelligence within specific socio-cultural and political contexts, where the determination of whose knowledge is valued can yield varied responses. Normatively, it establishes the criteria for assessing AI design and governance: fostering equal epistemic agency, embracing a diversity of knowledge, and ensuring transparency regarding knowledge assumptions and limitations.

Epistemic justice transcends the mere enhancement of transparency in biased datasets or algorithms; it seeks to redefine the foundational concepts of our knowledge systems. This allows us to inquire not only about the fairness of technologies but also about whether they are constructed upon inclusive and reflexive epistemologies. In this sense, technocratic solutions are integrated into a broader imperative to move beyond technical aspects and engage with the significant philosophical implications of ethical, social, and political consequences in the realm of knowledge within a digital landscape.

## 3. AI as an Epistemic Agent and Infrastructure

Machine learning and AI now occupy an important position in the knowledge ecologies of societies. Such AIs are not simply systems or tools anymore, they are part of the knowledge production, dissemination and legitimization process. People interact with the world through AI with the help of recommendation engines. This has an effect on the discourse. There are also analyses and decision-making that are automated. This can be seen in law, finance, and medicine. In this respect, this section argues, AI should be conceived as more than an epistemic

agent-a non-human one, but also an epistemic infrastructure whose design, deployment, and governance represent and replicate existing structures of knowledge and power.

The term AI refers to systems that may become *epistemological agents* in certain constraints, systematically gathering, processing, and disseminating information in ways that others come to know or hold beliefs about. This is partly based on *philosophies regarding technology*, particularly *actor-network theory*, with significant grounding in Bruno Latour's argument that agency is distributed amongst networks of human and non-human actors. AI can facilitate content development across all consumer brands, intellectual property, and media and content agencies. Their algorithms determine what is seen or unseen, stressed or ignored, welcomed or questioned.

The wider role of AI, however, is as *epistemic infrastructure*. This refers to an institutional and systemic framework of knowledge architecture embedded in platforms, datasets, machine learning models and interfaces. Such infrastructures are rarely neutral. They make choices about whose data to collect, what to measure, whose language to accept and whose standards of truth to use when designing. Helen Nissenbaum's idea of *contextual integrity* is based on the view that all information flows are situated in a normative social context. AI often breaks this context with data and analyses that are decontextualized and depend on spare statistical reasoning.

One example is natural language processing (NLP) systems and large language models (LLM), which are trained on extensive corpora often sourced from the Internet. These corpora frequently over-represent the powerful languages, cultures and classes. Consequently, the knowledge produced by the AI is largely biased against the mainstream, yet favourable to local, indigenous, or oral knowledge. In other words, we can speak of *an epistemic narrowing*, where the diversity of knowledge present in the world is reduced to formats which are intelligible to algorithms that reproduce the most dominant hegemonies.

The situation is further complicated by what is more accurately referred to as *algorithmic opacity*, which hinders both users and developers from fully understanding how AI systems reach their conclusions. This 'black box' nature of modern knowledge systems contradicts traditional philosophical concepts of public reason, deliberation, and *rational justification*, all of which are fundamental to democratic knowledge practices. When any challenge to epistemic authority is transferred to these opaque systems, the conditions for epistemic accountability are significantly weakened. As Frank Pasquale notes in *The Black Box Society (2015),* the rise of

algorithms whose operations are unclear will gradually eliminate deliberation, replacing it with automatic reasoning that undermines the transparency essential for epistemic justice.

One of the other pressing issues in this context is automation bias, the human tendency to over-rely on the outputs of AI systems, even if the information produced seems to contradict personal judgment or common sense. This bias effectively lends undue epistemic authority to AI systems, allowing them to act as a greater truth arbiter in regards to many aspects of life, from diagnoses of illness in healthcare to judgments about financial risks. In this case, AI moves beyond existing simply as a tool – this AI is more like a *legitimating mechanism* of certain types of knowledge while delegitimizing other types of knowledge, usually without critical reflection.

The role of AI as an epistemic infrastructure is amplified in the space of global development or governance, where purely information-based predictive analytic modes are often employed to address social problems such as poverty, migration, and subsequent social decisions regarding how to respond to pandemics. Scholars such as Lucy Suchman and Claudia Aradau have argued that these systems emerge through reductive logics and render complex social issues into measurable variables. These not only erase epistemic diversity but also reinforce technocratic modes of governance that exclude community-, experience-, or place-based knowledge systems. In this context, AI can be construed as a new form of epistemic *extractivism* through which knowledge can be extracted, abstracted and commodified without regard for where it comes from and/or the ethical issues of extracting knowledge.

The serious implications of these developments for philosophy are profound. Traditional epistemology has typically focused on a specific type of subject: the individual knower and propositional knowledge. However, it is evident that human intelligence renders knowledge as a *relational, infrastructural, and technologically mediated construct.* This transformation necessitates a significant departure from classical notions of the 'knowing subject' and instead emphasizes the distribution of *epistemic agency* across socio-technical networks. Who is responsible for constructing these systems? Who subsequently determines what qualifies as knowledge? And who possesses the authority to contest the outputs generated by algorithms?

In response, certain scholars have proposed an alternative perspective through the lenses of *design justice and data feminism*, aiming to foster broader diversity and enhanced inclusion within participatory epistemic infrastructures. This concept may encompass the outcomes of community-driven design initiatives, the specific motivations for transparency in data sourcing, and a critical understanding of power imbalances. Articulated in these ethical frameworks and

with corresponding epistemological commitments, these AI systems should not be viewed merely as neutral optimizing instruments, but rather as *normatively influenced agents* involved in the creation of social meaning.

Artificial Intelligence systems should not be viewed solely as technological artifacts; rather, they must be understood as *epistemic agents and frameworks* embedded within socio-political environments. The sources of knowledge, as well as the circumstances under which they are acquired, are crucial for comprehending this dual perspective, which is essential for engaging with the profound philosophical implications of epistemic justice in the digital era.

## 4. Mechanisms of Epistemic Injustice in AI Systems

Artificial intelligence is frequently presented as a neutral or objective instrument for improving decision-making and knowledge management; nevertheless, in reality, its development and implementation violate and exacerbate profound epistemic injustices. These injustices are not trivialized by the structural context; rather, they are inherently structural, ingrained in the array of processes through which AI systems are designed, trained, validated, and deployed within the socio-technical landscape. In this section, I will consider particular *mechanisms by which AI systems contribute to the perpetuation of testimonial and hermeneutical injustices* in the context of datafication, representational bias, algorithmic opacity, and epistemic outsourcing.

### A. Datafication and Epistemic Reductionism

There are many forms of mechanisms under which digitalization is seen as the first necessity. By *datafication*, human experience in the form of actions and interactions is transformed into digitally quantifiable data. This reduction process privileges what can be measured and encoded above that which holds meaning depending on context, affect, or relatedness. This renders knowledge externally, i.e., what we can know is simplified to fit into the predication of the statistical model that is flattened in its ontology. Moreover, the very act of measuring data rests on some value-laden presuppositions about what counts as relevant, measurable, or intelligible, very often underestimating other non-dominant epistemic perspectives.

Such systems are being used for predictive policing: collecting and analysing crime data to predict future criminal acts. As Andrew Ferguson and Virginia Eubanks have shown, however, such data are largely generated through historical patterns of surveillance and over-policing of marginalized communities. The algorithm treats systemic injustice as neutral input, creating *feedback loops* that perpetuate epistemic and material marginalization (Ferguson 2017; Eubanks 2018). In doing so, it contributes to *testimonial injustice* because the promised

neutrality is put forth to deny the experience of affected communities and endorse such views that really have bias concealed within them.

## B. Representational and Ontological Bias

Second, it involves a *representational bias* in the datasets that train machine learning models. Most of these larger systems, such as those which cover the field of natural language processing or image recognition, operate off datasets that skew heavily towards being Euro-American, Anglophone, and affluent. This type of bias not only distorts statistical outcomes; it also shapes ontological aspects: it dictates which identities, experiences, and modes of expression are recognizable to the AI system.

Safiya Noble's work *Algorithms of Oppression (2018)* shows how, over the years, searches about Black women generated results from Google's algorithms that often connect Black women to harmful stereotypes. These results are not just technical problems; they are also examples of *epistemic violence*—an articulation of oppressive epistemologies presented as algorithmically neutral. Furthermore, facial recognition technologies have been shown to perform poorly with people with darker skin, particularly women, because there was no representative (sufficient) data (Buolamwini and Gebru, 2018). This absence or misrepresentation leads to *hermeneutical injustice,* as the visibility and experiences of that group have been misread as a systematic attempt to erase and misinterpret their experiences.

## C. Algorithmic Invisibility and the Black Box Problem

The third, and possibly the most basic, one is *algorithmic opacity*, which relies on the inability of people affected by advanced systems to make sense of or contest the results they have produced. This is often described as the *black box problem*, which leads both to technical complexity and proprietary secrecy, essentially separating knowledge *authority from epistemic responsibility*. Often the people or communities do not have the process that guided the decision made algorithmically (for example, decisions whether to grant a loan, assess medical risk, or decide on the acceptance to epidemic on the basis of algorithmic risk assessments.)

This lack of transparency undermines the essential elements of epistemic justice—namely, transparency, contestability, and reflexivity—thereby preventing the possibility of contestation and reinterpretation of algorithmic outputs. This situation compensates for the feigned denial of individuals' epistemic agency, which is crucial for them to comprehend, critique, or evade knowledge claims that directly impact their lives. As Lilly Irani (2019), the philosopher, puts it, "this produces a 'technocratic mystique'-centralizing expertise and dismissing the epistemic labour of ordinary users" (Irani, 2019).

**D. Epistemic Outsourcing and the Denial of Local Knowledge**

Another mechanism of misappropriation is what we call *epistemic outsourcing*, delegating interpretive and decision-making functions to AI systems that were developed in contexts detached from the communities that they purport to serve. In other instances, such as this, the epistemic misappropriation often leads to marginalizing the *local, indigenous, or experiential knowledge systems* and example development projects using AI to monitor agricultural activity or environmental risks that usually rely on satellite and remote sensing data, thus circumvention of the situated expertise of local farmers and inhabitants (Molnar & Gill, 2018).

Two forms of epistemic injustice affect local knowers. First, their *testimonial credibility* is denied-anecdotal or unscientific-their knowledge is typically dismissed. It does also suffer a *hermeneutical exclusion* in that the interpretive frameworks used to make sense of their realities are externally imposed, and these are culturally incongruent. In these cases, instead of serving as instruments of empowerment, AI systems are becoming mechanisms of epistemic colonization, thus reinforcing hierarchies of knowledge that reflect geopolitical and economic disparities.

**E. Automation Bias and the Devaluation of Human Judgment**

In the end, *automation bias* - the inclination for humans to lean into outputs taxonomized from machinery - creates an epistemic landscape in which information from AI is inappropriately prioritized over human reasoning. This creates a situation in which professionals like teachers, doctors, or social works lose their authority because their actions no longer reflect the predictions of automated algorithms. In this instance, AI systems alleviate the *epistemic burden of proof* from human agents, and asks the question, "What is counter to the algorithm that justifies your disagreement?"

These situations have ramifications, especially in high-stakes circumstances like health care, criminal justice, and education. Disregarding human reasoning becomes a prerequisite, pushing a technocratic agenda, and stripping the epistemic authority from epistemic subjects - whoever that may be. Philosophically, this suggests an abandonment of pluralism and dialogue systems that democratic knowledge relies on.

**5. Towards Epistemic Justice: Ethical and Philosophical Interventions**

Considering that modern AI systems incorporate elements of epistemic injustice, simply rectifying biased algorithms is insufficient. Instead, it is essential to reconsider knowledge systems in a manner that is both *philosophically sound and ethically responsible*: examining the structure of these systems, identifying whose perspectives are highlighted, and analysing

the distribution of epistemic agency. This section will investigate a range of interdisciplinary approaches—from design justice and participatory epistemologies to decolonial and feminist critiques—all focused-on reshaping AI to uphold epistemic justice as a *moral imperative and a prerequisite for democracy.*

## A. Reframing AI through Epistemic Pluralism

To adopt epistemic justice, the fundamental knowledge acknowledged is *epistemic pluralism*, which posits that there are multiple valid ways of knowing, encompassing perspectives from various cultural, social, and experiential backgrounds. Nevertheless, the epistemologies of most AI systems tend to favour *scientific rationalism, statistical regularity,* and data positivism. Philosophers like Sandra Harding and Boaventura de Sousa Santos have facilitated the democratization of epistemology by integrating marginalized knowledges and what are termed "epistemologies of the South" (Santos, 2014).

The standard and formality of the rewritten changes were: In establishing epistemic pluralism into artificial intelligence requires serious changes in the construction of datasets and how models are trained. It requires not just intention with regard to deliberately incorporating marginalized voices but an intention that these voices are part of the construction of epistemic meaning, rather than simply being included tokenistically. This transforms AI from being viewed as a singular universal intelligence, into being seen as a *site of negotiation under the weight of differing cultures of knowledge.*

## B. Design Justice and Participatory Infrastructures

The main argument within *Design Justice*, as outlined by Sasha Costanza-Chock in 2020, is to deconstruct systems of technology and their making. The main assumption here is that the individuals who are most impacted by a design choice should have the most power over that choice. In this sense, the traditional design begins to take form in *community-led* design, wherein marginalized communities, in their history, have an inclusive voice to define problems, create objectives, and develop solutions.

This means that these communities will now have a voice in the conversations around data governance, consent, and accurate representation. The *epistemic agency* of those who know will therefore be acknowledged and there will be no hierarchy or separation of experts and lay people. This model can comfortably suit *relational epistemologies* that value dialogue, mutual recognition, and shared authority in knowledge production.

Participatory design must promote acts such as algorithm audits, transparency and accountability strategies, as well as impact assessments for the *governance of AI.* Scholars such

as Ruha Benjamin and others have argued for what they call "abolitionist tools". These notions seek to not only dismantle oppressive and biased structures but work to abolish and dismantle those systems while building just and humane alternatives for the existing systems (Benjamin, 2019).

## C. Feminist Epistemologies and Situated Knowledge

In this context, feminist philosophy of science, as seen in Donna Haraway's work, suggests a view of situated knowledge which critiques the so-called God trick, which sees all from a nowhere perspective. This perspective will surely pose a direct challenge to the *illusory objectivity* that AI systems often mistakenly think they have. Situated knowledge posits that all knowledge is produced from specific positionalities; embracing this partiality increases epistemic validity, rather than decreasing it (Haraway, 1988).

This recognition emphasises the socio-political positionality of the designers, annotators, engineers, and end-users in AI. Hence, it calls for the prototype of context-aware systems that demonstrate the values, histories, and power structures of their context. *The feminist principles* of data ethics articulated by Data Feminism (D'Ignazio & Klein, 2020) raise these principles— interwoven, as related to transparency, intersectionality, and accountability, which can serve as guiding stars for equitable and inclusive AI systems.

## D. Decolonial Approaches to Epistemic Justice

It goes beyond the questioning of specific technical and representational biases in AI; decoloniality interrogates the underlying *epistemic assumptions* behind these systems. Specifically, it challenges how western, enlightenment-based epistemologies became dominant and continues the process of *epistemic erasure* of indigenous and non-western ways of knowing. Decolonially, of course, refers to Waslot Mignolo and Catherine Walsh's very numerous arguments: decoloniality is not only wrought with the diversification of knowledge but is all about delinking with colonial frameworks of knowing (Mignolo & Walsh, 2018).

With regard to AI, it would involve the resistance towards the generalization of equal technical standards, ontologies, and classifications, especially on how they would assimilate the beauty of cultural difference. The knowledge that should repair would be an indigenous-cantered, oral, and relational knowledge system. They talked about decoupling epistemologies that would provide other resources to the AI systems that commodify and extract without permission and work to obtain instead communal, owned through common means of knowledge exchanges based on ethical principles.

**E. Institutional and Policy-Level Reforms**

With all this said, all work toward epistemic justice in AI must be entrenched in institutions and public policy. It comprises:

- Enabling *algorithm transparency* and explainability in high-stakes decision systems.

- Conceptual development of *epistemological impact evaluations* along with environmental and social impact assessments.

- Finally, *implementing public infrastructures that allow for open, diverse, community-curated data.*

- Providing funding for interdisciplinary research that will put philosophers, technologists, sociologists, and affected communities in dialogue together.

Public organizations (universities, think tanks, regulatory authorities, etc.) should take it upon themselves to define and guide *epistemic accountability* in the public realm. It will be hard to show value to the latter role of the philosopher here, not just as critiquing the assumptions of AI, but rather in collaborating together towards a proactive co-design of novel architectural structures of epistemology.

**6. Conclusion**

In summary, this study sheds light on the important role AI plays, in both its epistemic agent and epistemic infrastructure forms, in reinforcing the pre-existing epistemic and power hierarchies that disadvantage various communities. Findings demonstrated that AI systems propagate testimonial and hermeneutical injustices in part due to biased training datasets, the transparency and adjudication of programming systems, automation bias and non-Western, Indigenous, and experiential knowledge exclusion from algorithms, each an integral feature of design, employed and conducted by governance structures that articulate the politics and geographies of AI algorithms as a whole. The implications of these findings are far-reaching, highlighting the active nature of AI technologies and their failure to be neutral or objective and identifying an urgent need to rethink the ethical frames of AI. More importantly, if the epistemic injustices are not corrected consider future scenarios in which algorithmic knowledge systems confer a degree of epistemic homogeneity adverse to plurality, democratic activity, and epistemic communities that are already disadvantaged. In conclusion, this research advocates for a vital reconsideration of AI ethics and governance via a lens of epistemic justice including an emphasis on design justice, the development of community-oriented, participatory and collaborative infrastructures; the advancement of epistemic pluralism that acknowledges multiple epistemologies, and the incorporation of feminist and decolonizing critiques of AI into

policy and practice. As an example, it is critical to collaborate with AI developers, educators, policymakers, AI ethicists or philosophers, and advocates/activists to ensure inclusive, transparent and accountable engagement with AI. Organizations, institutions, and programs can become partners in the community assessment for epistemic impact in a similar way to how they evaluate for technical impact. They can also foster interdisciplinary research with impacted communities as just that - impacted communities, and not subjects, as co-creators of knowledge. The future of equitable AI is not just dependent on reckoning with current flawed systems, but also depends on changing the epistemological ideals that underpin those very systems. It is also imperative that the knowledge that informs ethics in this morphing AI landscape is produced in ways that are democratic, contextual, and just.

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# Probing the Adoption of AI-Driven Tools in Research

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## Abstract

Integration of Artificial Intelligence (AI) transformed the generation and dissemination of the knowledge. AI influences the research processes right from designing to communication of the findings to the world. The present study tried to capture how AI-driven tools utilized by doctoral research scholars for carrying out researches. The study probed the benefits derived from using these tools along with the challenges encountered by them. Exploratory research design was employed by the investigator. 26 doctoral research scholars pursuing doctorate degree in various discipline from a central university located in NCT of Delhi were interviewed based on semi-structured schedule. The findings of the study revealed that research scholars frequently used AI- tools for searching literature, doing literature review, data analysis, academic writing, reference generator, paraphrasing and editing. The tools included RefSeek, Litmaps, Connected Papers, ChatGPT, Paper Digest, Flourish, Paperpal, Grammarly, etc., however, adoption of these tools was advantageous to them in terms of advancement, digital fluency, accessibility and reduction of human dependency. Researchers also encountered numerous challenges such as lack of human emotions, ethical concerns, authenticity and over dependency on technology. This study suggests that using AI tools definitely enable to do smart work and save resources but it should be used in a way which doesn't affect humans thinking and potential.

**Key-words**: Artificial Intelligence (AI), AI- driven tools, Adaptability, Digital Fluency

## Introduction

Artificial Intelligence has transformed the landscape of Education. It offered a new approach to generate knowledge and make it presentable in different formats. Learning as the key component of education revolutionized after the emergence of AI. This has been found to be beneficial in terms of enhancing productivity, speed, access and connecting with peoples for meeting learning goals. Gateways to access information from diverse sources has been created. However, it is utmost significant to have a discussion for taking logical decisions regarding optimizing the use of such tools (Chubb et al., 2021). AI integrated in the dimensions of education range from planning to evaluation. It can be customized based on the need and the

context (Ekin et al., 2025). Persons with special needs has been supported through AI tools (Gursoy & Cai, 2024). The dynamics of learning changes due to interplay of AI factors in the learning processes. Students as a component of the learning in combination with AI can act as an inquirer and receiver of outputs whereas AI work as the content generator and provider, however, teacher has been provided the role of enabler and observer in which teacher see the interaction developed by students by adopting AI functions and encourage and facilitate the process of learning by eliciting more engaging sessions in collaboration with AI (Chiu, 2025). Adoption of AI definitely calls for a regulatory guideline otherwise it may invite legal and ethical issues (Gursoy & Cai, 2024).

Application of AI tools not only influence the learning but it also shifted the process of doing research. It raised the level of the researches conducted and promoted the integration of interdisciplinary and cross-disciplinary knowledge in collaborative work of researches. It can support in processing large scale data and bring accuracy in results (Wan et al., 2025). AI leveraged the process of process of research proposal system by automatizing with reference to submission, review and tracking. Human resources can be diverted for another tasks. It can bring collaboration with various experts across the world and also connect with the possibilities of funding (Munagandla et al., 2024). There are many tools available in the cyberworld which can shape the research in another tangents. However, few of them are free to access whereas others are paid ones. Still researchers are harnessing the potential of these tools. Thus, the present study was conducted to find the purposes behind adoption of these AI tools in the researches, how these tools are added advantage for doctoral researchers and challenges faced by them due to utilizing these AI tools for the work of research.

**Research Methodology**

The present study adopted exploratory research design, which was conducted on 26 Doctoral researchers belonged to different departments of a central university situated in NCT of Delhi. The selection of university was based on convenience sampling and researchers were selected by using random sampling method. A Semi-structured interview schedule was developed concerning questions such as listing of AI tools used with the purpose behind, positive outcomes felt after using such tools, challenges encountered due to use of AI tools. The responses obtained from the interviews were analyzed by thematic analysis.

**Objectives of the study**

1. To identify the purposes of using AI-driven tools in research work.
2. To explore the benefits derived from using AI-driven tools in research work.

3. To understand the challenges encountered due to usage of AI-driven tools in research work.

**Results and Discussion**

Analysis of the responses captured through interviews resulted in the formation of themes, which are discussed as follows:

***Purposes behind using AI-driven tools in research work***

*Searching existing related studies*

Most of the respondents mentioned that they use AI-powered tools in the research work for searching existing studies due to its quick and relevant output in a single search. Adding to this, other cited that AI tools give more comprehensive and significant studies at the top as compare to the traditional searching methods. In a single search, it covers multiple databases and resulted into expand and accurate search. These tools offered them recommendation based on previous searches. The AI-powered search quoted as specific and accurate. The AI-tools which were used by the respondents for searching existing studies included Consensus, Scinapse, Scispace, Semantic Scholar, RefSeek.

*Reviewing existing related studies*

"Reviewing full paper is not as difficult as it was earlier" cited by one of the respondents. Searching and reviewing are two different task and for these two different tasks, separate category of tools used by the researchers. For reviewing the existing literature, tools such as Connected Papers, Elicit, Research Rabbit, Raxter, Mendeley, Litmaps. These tools provide the literature with summary and pictorial representation of the paper which enabled them to understand the complexities involved in a paper. These tools helped them to identify influential work and the person involved. These tools update frequently to match the pace of development. It was also told by the respondents advanced sorting and filter features helped them to track studies very easily. Paper Digest and SummarizeBot was used by researchers to study summary of the whole papers. Paperpal is another tool used for multiple purpose such as searching, summarization, citation and grammar tips.

*Streamline the citations*

Majority of the respondents revealed that they organized their readings in the form of various folders in Mendeley. This would be helpful to them generate citations in a single tap. Other than Mendeley, QuilBot was used by the researchers to generate in-text citations and end-text citations. The accuracy of these tools was suggested as good by the respondent users.

*Producing content*

It was also reported by the researchers that for informal writings such as letter, mails etc., they used ChatGPT. To get answers of some random queries, they used this tool as well. "It was also used to search explanation of any pictures and graph" added by respondent. Gemini was also used by few of the respondents for the same content generation purpose.

*Paraphrasing*

To paraphrase the content, QuilBot was the only tool which was used by majority of the researchers. It was the most trustable tool and even their university library also conducted a session on this to orient about its features. It was revealed by the respondents that it offered them different styles such as standard, fluency, creative and shorten. It has termed as efficient but human need to see it otherwise the essence of the content lost.

*Visualization of content*

Respondents revealed that for making presentations, they use Canva, Gamma app and Prezi. These made the content crisp and easy to understand through graphics. Adding to this, one said through Gamma app modification of old and boring slides carried out with ease. Even, slides with prompt can be generated on any topic just by a single command. Another effective tool named "Flourish" was used by researchers to generate charts and maps.

*Checking grammatically*

Respondents said that they used Grammarly for checking grammar aspects of their piece of work. It has been claimed as more reliable by them. Other than this QuilBot was also used by few of the respondent for editing their work. One of the respondents also cited the use of Ginger for such work.

**Positive consequences stemming from employment of AI tools**

*Lead towards advancement*

It was stated by most of the respondents that adoption of AI tools in their work make them aware about the latest development of skills and knowledge which in turn made them to use it. Though, there are many options available in terms of application of AI tools but at the same time, it propels them to think how to use and where to utilize. It offered a sort of skills training and prepare for this competitive century. It was also quoted by one of the respondents that:

"*AI tools help the users of AI to stand out from the lot; I use it but wisely which offer me edge over non-users*"

This signifies that in future, segregation would occur and maybe it narrows down the future endeavors for non-users of AI.

*Raised digital fluency*

Respondents asserted that adoption of AI tools transform their abilities right from search literature to crafting a research paper. Continuous utilization of such platforms increased their automation, devising personalized learning trajectories, hands on training and seeking feedback for bringing improvement. Access and harnessing the tools potential offer free resources, software, tutorials, data interpretation, writing, reading, extracting, summarizing like functions which develop a sense of ownership and provide them a hold over their work. These all contributes to be become more digitally competent and fluent.

*Communication and Collaboration*

It was also reported by the respondents that AI powered platforms such as Microsoft Teams, Mendeley, Research Gate, RStudio, Semantic Scholar, Grammarly, Research Rabbit bestowed them with the opportunities to communicate and collaborate in various formats. It was in the form of sharing information, exchanging research work, visualization of the work, writing and reviewing for common projects, taking feedbacks, holding virtual sessions, data interpretation and analysis, academic writing, networking and many more such relevant functions.

*Resources efficient and Time-saving*

This was inferred from the responses of the respondents that earlier access to the literature/ existing work of the research area required physical visit of the library which offered very less information, this was later replaced due to advent of technology, however, the searching from the databases was still time consuming and tedious job. Now, after the arrival of the AI powered platforms, literature searching tools became so advanced, shows highly relevant and connected work in a single search. These tools offered them summary of the articles/papers in just a few seconds. They could read the part of the paper they wanted to.

It was also told by the respondents that they manage their bibliographies and reading list through these tools only which save their time, energy and resources as well. Many of the tools offered free access and even paid ones are less costly in comparison to the investment in other means of doing task.

*Reduction of Human-Dependency*

Majority of the respondents said that previously they relied on human support for learning something new and whenever stuck in between while performing any task. When they started using AI tools in research work, this dependency got reduced to an extent as most of these are user-friendly and easy to use. These platforms have virtual assistants and chatbot to provide explanation and solutions. Manuals and Tutorial placed on the websites of these tools served

as an added advantage. Through several prompt generative AI tools, respondents add their queries in the form of text or image with command and get instant solution or answer.

*Accessibility*

Respondents revealed that inclusion of AI tools improved their access to the literature review, data analysis, data presentations and sharing of findings with other people. It was told by one of the respondent scholars that

*"I searched a particular keyword for accessing literature review on Semantic Scholar, then I started getting so many related studies on my mail account".*

This signifies the importance of using AI tools that even prompts appeared later when you search something.

### Encountered array of challenges due to utilization of AI tools

*Over-reliant on AI tools undermines critical thinking, creativity and problem-solving skills*

It was told by few respondents that adoption of AI tools rendered to focus more on seeking type behavioral practices which sometimes makes them a mere seeker of information through generative AI platforms. Rather than thinking the solution on own first, respondents said they seek help from these tools first. This exhibit that it affects them in terms of critical thinking, problem solving and creativity. To devise something innovative such platforms were their preference, this highlights the suppression of skills of creativity.

*Overdependency on technology/ machine*

Respondents themselves asserted now a technology/machine culture has been created which made them to more rely on AI technologies to keep themselves updated to meet latest demands of the era. Manual designing and development to devising strategies of work was overtaken by AI and mindset of such kind has been setup. Basic understanding/intent behind and the processes of the work is no longer required as due to AI tools, people turned out to be more product oriented.

*Authenticity*

Another obstacle quoted by the respondents belongs to authenticity of the information. It was told by respondents that using generative AI such as ChatGPT, Deepseek doesn't guarantee the authenticity of the information. Searching and obtaining research studies with proper author credentials served as the proof of trust to an extent but these generative texts are relevant or true, that's questionable or cause of concern.

*Increased competitivity*

Respondents that using AI tools in the research work created a sort of competition among those who can use it efficiently or those who are not using it. It created a divide and form the categories "AI-literate and AI-illiterate". This created a sense of competitiveness among people those who are doing fast-paced work by using AI tools and those who are using non-AI based technologies.

*Ethical issues*

It was reported by respondents that AI tools store personal data and information of the system which is a breach of privacy of user. There is lack of transparency in the algorithm processed by AI for a particular command. It perpetuates biases as told by respondents:

"I searched for an Indian boy image thrice as a part of one of my works, every time it came up with brown complexion boy"

This is just an example shared by the other, there could be other possibilities too if explored. Other respondent shared that attacks from AI-driven malwares pose potential risk to the user data and raise security concerns.

*Human Values and Emotions*

It was quoted by majority of the respondents that AI tools have no emotions. It doesn't bother about emotional wellbeing of the user. Another one added to it that:

*"Some of my friends aren't good at using technology, when they see those who are using it, they become insecure and stressed"*

The issue of getting insecure can be tackled through learning AI tools. It was also reported by the respondents that AI fails to understand emotions and doesn't concern with emotions and feeling. Emotions are crucial for learning but it is more mechanical. More use of AI in work had reduced their human interaction which limit their human connections.

*Adaptability issues*

Due to frequent updates of list of various AI tools for different works and within that also updating of features of these tools were cited as the challenge by the respondents. Sometimes they juggle with such changes. It confused them how to go about it. Respondents said that it is difficult to decide which tool is safe to use for the purpose. Such state of dilemmas posed issue of adaptability with the context.

**Conclusion**

The present study unpacked that AI tools such as Consensus, Scinapse, Scispace, Semantic Scholar, RefSeek, Grammarly, Quilbot, Ginger, Flourish, Gamma app, Mendeley for the

purpose of searching and reviewing the literature associated to their research area, writing and editing, generating citations, summarize and extract meanings from the papers, paraphrasing and presenting content. These tools speed up their process of research and support in meeting the current needs of the era. It reduced human-dependency and enhanced their digital fluency. Integration of AI tools in the process of researches calls for decision making which have to sound ethical, however, overdependency has to be avoided, dominancy should be in terms of Human over AI not vice-versa.

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# A Study of Social Skills of Teenage Students in Relation to 16-Personality Factors

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## Abstract

The present study was conduct to understand the relationship between social skills and 16 personality factors and to know the effect of personality factors on social skills among the higher secondary school students. The present study was conduct on a stratified random sampling of 188 students of higher secondary school of Bareilly district in Utter Pradesh. In this study Social skills and Rating Scale (SSRS) by Vishal Sood and Arti Anand and Hindi Edition of '16 PF VSJ 1970' Prepared by: S.D. Kapoor, tools were used. After analyzed data a significant relationship is found between social skills and personality factors and personality factors affect the social skills. After Internal Comparison of Social skills among students having different orientation of P. Fs, the four factors B(Intelligence), F(Surgency/Desurgency), H(Threcttia/parmia), N(Artlessness/Shrewdness), Q2(Group Adherence/ Self-Adherence), Q4(ergic Tension) have mostly affect the social skills on the basis of gender, school types and family types.

**Keywords:** Social skills, Personality Factors, Teenage, Students, Gender, School, Family

## Introduction

Education plays a vital role in shaping every aspect of our lives. A truly successful individual is one who understands how to apply their education practically. For students, simply memorizing textbooks and scoring high marks is not enough. What truly matters is understanding how education can enhance not only their own lives but also positively impact those around them.

Personality is a combination of a person's social skills, character traits, attitudes, psychological tendencies, beliefs, and motivations that collectively form their identity. It is not limited to one's appearance. Personality development involves growth in every dimension of a person's life.

It is widely accepted that today's students are tomorrow's citizens. Therefore, it is essential to equip them with a range of skills that allow them to live successfully and satisfactorily in society. With modernization and social change, there is a growing demand for more efficient individuals—those who are socially skilled.

There is a positive link between a student's personality and the social skills they possess. These skills are essential for managing interpersonal relationships, making sound decisions, communicating effectively, regulating emotions, and achieving professional growth. Without these skills, students may struggle to contribute meaningfully to society.

Research supports the importance of social skills. Corrigan et al. (1993) found that social skills and behaviours can be learned and strengthened through regular interactions with others. Social skills training allows individuals to expand their range of behaviours and succeed in different social situations. Burleson (1995) observed that individuals lacking in social skills are more prone to issues like depression, social anxiety, loneliness, and addiction. Furthermore, Segin and Geertz (2003) found that deficiencies in skill development can result in emotional problems such as anxiety, frustration, and social withdrawal. Clearly, effective use of social skills is critical for one's social, emotional, and professional well-being.

In today's context, many of the world's major challenges can be addressed through a better understanding of human behaviour. Educationists, counsellors, and psychologists have often argued that some students underperform academically due to poor social skills. Adolescents, in particular, tend to be self-centred and need extra support to develop social maturity. Social skills help them to adjust to various social environments and understand others' perspectives.

Educators and researchers are increasingly focusing on assessing and building adolescents' social skills across different social contexts, including the classroom, where interaction with peers and teachers is essential for effective learning. However, the excessive use of the internet and digital media can hinder the development of these skills. Many teenagers now prefer solitary online activities over face-to-face interactions, limiting their social growth.

Studying social skills is essential because they are shaped by a complex social environment and play a crucial role in maintaining stability and coherence in one's personality. With increasing incidents of school violence and behavioural issues among Indian students, there is an urgent need for evidence-based strategies. Adolescence is a particularly sensitive stage of life. If teenagers' social skills are properly nurtured and their values guided in the right direction, they can become great assets to society.

Through education, adolescents develop essential qualities such as reasoning, creativity, emotional intelligence, problem-solving skills, and a positive attitude. These attributes—closely linked to personality—help in shaping a modern and well-adjusted individual. However, when students lack social skills, it often results in undesirable behaviour rooted in personality issues. These problems are often caused by imbalances in the OCEAN personality

model—Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. This study aims to explore the thoughts, emotions, and behaviours of teenage students through the lens of these personality factors and to examine how a lack of social skills affects their conduct.

**Need and Significance of the Study**

This study titled "Social skills Related to Various Personality Factors of Teenage Students" aims to explore and understand the issues faced by teenagers who struggle with social skills due to certain personality traits.

Often, these deficits go unnoticed, but they can manifest in various negative behaviours such as anxiety, stress, poor adjustment, hesitation, fear, and more. By identifying the root causes of these issues, this research can provide valuable insights into the psychological and behavioural challenges faced by adolescents.

Key Objectives and Importance of the Study:

1. This research offers a comprehensive insight into how social skills are related to personality traits of teenage students.

2. It helps to identify the various environmental, social, gender, cultural, and peer-related factors that influence social skill development.

3. The findings can contribute to the field of education and support teenagers in their academic and career growth.

4. Being a survey-based study, it can help in designing special education strategies for students with unique social or emotional needs.

5. The study plays a vital role in diagnosing the social skill deficiencies related to personality traits, allowing for timely intervention and support.

**Objectives of the Study**

To understand the relationship between the social skills and personality factors of higher secondary schools' students.

To know the effect of personality factors on social skills of higher secondary schools' students.

Hypothesis of the Study:

There is no significant relationship between the social skills and Personality Factors of higher secondary school students.

There is no significant effect of personality factor on social skills of higher secondary schools' students.

**Literature Review**

Rahimi (2022) conducted a study to examine the impact of personality traits and social skills on behavioural-emotional interactions among middle school students. A sample of 354 students participated in the research. The findings indicated that only the trait of agreeableness had a positive influence on appropriate social skills. The study concluded that task-oriented factors, agreeableness, and emotional stability contribute to discipline, perseverance, Interest in learning, and concentration, ultimately enhancing students' emotional interactions.

Okeke et al. (2022) investigated the relationship between parental attachment styles, personality characteristics , and social abilities of secondary school students in Anambra State. The study involved a sample of 237 students from selected schools Results revealed that a secure parental attachment positively correlates with the social skills of in-school adolescents, whereas anxious-resistant, anxious-avoidant, and disorganized attachment styles negatively impact social skills. Based on these findings, the study recommended that parents adopt behaviours and attitudes that promote healthy relationships.

Monika (2023) explored the relationship between social skills and personality development. The study was conducted on a sample of 200 students from Sonipat district the results demonstrated a positive correlation between social skills and personality development among secondary school students. Furthermore, the study found no significant gender-based differences. The conclusion highlights the importance of providing a classroom environment that nurtures personality traits essential for personal growth, with teachers playing a key role in fostering such an atmosphere.

Rehman, Shah, & Malik (2023) investigated the development of social skills in secondary school students' behaviour in Punjab province. A sample of 1,723 students in the 10th grade was selected for the study The findings revealed that students generally practice various social skills, including communication, decision-making, interpersonal relationships, empathy, critical thinking, and creative thinking, although their application varies in different life situations. The study recommends that teachers incorporate activities such as games, debates, competitions, speeches, project assignments, and field trips to encourage the development of these social skills in students.

**Methodology**

The choice of method primarily depends on nature of problem chosen and objective in hand. Hence, keeping the mentioned objectives in the view, the present research work in intended to descriptive research in nature. Focus of the study is on higher secondary students located in Bareilly city, and the investigation will be carried out through descriptive survey method.

**Study Population**

Population of the study in hand be all students studying in class XI & XII, located in schools of Bareilly city. As to the best knowledge of the researcher, total 80 schools are delivering educational services at higher secondary level in Bareilly. These schools include 50 schools affiliated to UP. Board, 30 schools recognized by CBSE. To put together, a total of about 8000 students is estimated to be studying in class XI& XII in these schools All these students formed the population of the present study.

**Sample and Sampling Technique**

For the study of The Social skills Related with Students of higher secondary schools of Bareilly district, stratified random sampling method used. A sample is a small portion of a population chosen for observation. Its characteristics can be used to draw conclusion about the population it represents. The sample can make certain inferences about the characteristics of the population from which it is drawn; Contrary to common belief popular opinion, samples are not picked randomly in a careless manner rather they are selected in a systematic and random way in the first stage, the government/government aided and private higher secondary schools of UP board and are selected. Out of 80 schools, 19 % of the schools of Bareilly city randomly selected i.e., 8 government schools and 7 private schools. In the second stage male & female students of higher secondary schools selected randomly and 7 % students selected from each school out of 188 students. This way, a total sample of 188 students including both male and female students selected to form a sample of the study.

**Tools to be used**

Social skills and Rating Scale (SSRS) by Vishal Sood and Arti Anand

The Hindi edition of the 16 PF VSJ (1970), Prepared by: S.D. Kapoor.

Statistical techniques used:

In this study some followings statistical techniques were used- Mean, S.D, Percentage T – test.

**Statement of the Problems**

A Study of Social skills of Teenage Students in Relation To 16-Personality Factors.

Distribution of Social skills Score of Male and Female Students

| S.N. | Level | Male-94 | | Female- 94 | | Total | |
|------|-------|---------|------|------------|-------|-------|-------|
| | | No. | % | No. | % | No. | % |
| 1 | Above Average | 5 | 5.31 | 17 | 18.08 | 22 | 11.70 |
| 2 | Average | 47 | 50 | 73 | 77.64 | 120 | 63.82 |

| 3 | Below Average | 34 | 36.17 | 4 | 4.24 | 38 | 20.21 |
|---|---------------|-----|--------|-----|-------|-----|-------|
| 4 | Low | 8 | 8.51 | - | - | 8 | 4.25 |
| 5 | Total | 94 | 100 | 94 | 100 | 188 | 100 |



Percentage Chart of Male & Female Students
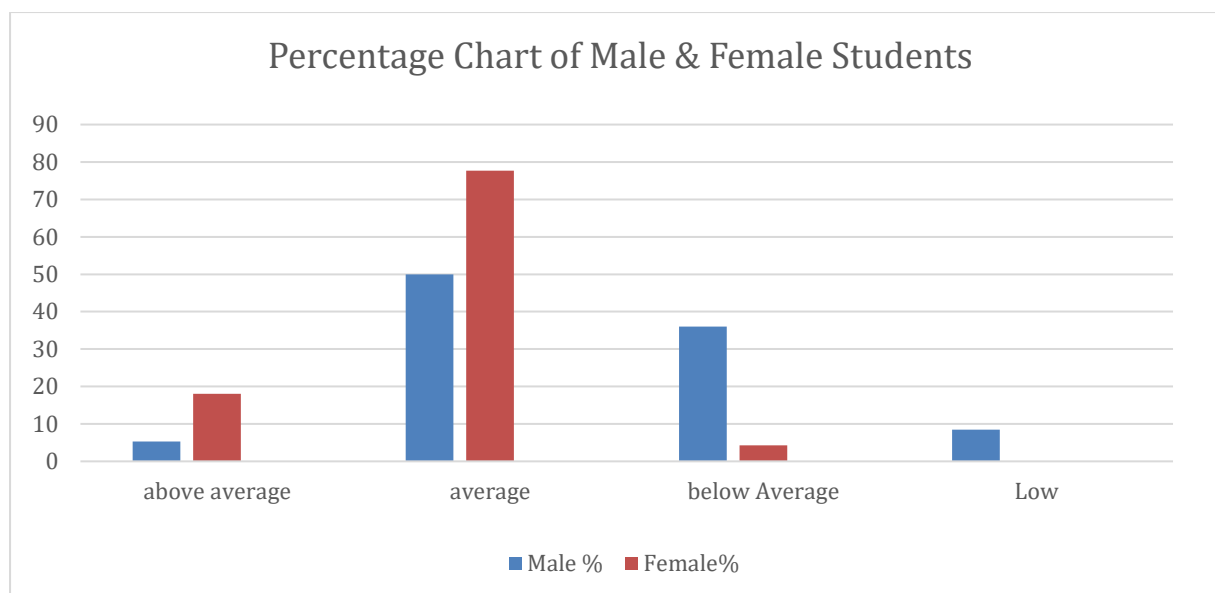
**Result and Interpretation**

Table shows that the gender wise distribution of higher secondary teenage students. In this distribution 94 male and 94 female students out of 188 students are taken.

The data was gathered using the help of SOCIAL SKILLS tool. The norm as shown in the categorized students' SOCIAL SKILLS into four categories: above average, average, below average. Students having z- score +0.51 to +1.25 are in above average, -0.50 to 0.50 in average, -0.51 to -1.25 in below average and -1.26 to -2.00 in low level of Social skills scale.

The researcher found that in male category only 5.31 % students have above average level of SOCIAL SKILLS, 50% has average, 36.17% have below average and 8.51% have low level of SOCIAL SKILLS

In female category only 18.08 % students have above average level of SOCIAL SKILLS, 77.64 % has average, 4.24 % have below average and 0 % have low level of SOCIAL SKILLS.

Finally, the researcher found that only 11.70 % students have above average level of SOCIAL SKILLS, 63.82 % has average, 20.21 % have below average and 4.25 % have low level of SOCIAL SKILLS.

The researcher found that girls have more Social skills in comparison to boys

Introduction table of factors

| S.N. | Low Sten Score (1 – 4) | factors | High Sten Score (7 – 10) |
|---|---|---|---|
| 1 | Sizothymia | A | Affectothymia |
| 2 | Low Intelligence | B | High intelligence |
| 3 | Lower ego strength | C | Higher ego Strength |
| 4 | Submissiveness | E | Dominance |
| 5 | DE surgency | F | Surgency |
| 6 | Expedients | G | Conscientious |
| 7 | Threctia | H | Parmia |
| 8 | Harria | I | Premia |
| 9 | Alaxia | L | Protension |
| 10 | Praxernia | M | Autia |
| 11 | Artlessness | N | Shrewdness |
| 12 | Untroubled adequacy | O | Guilt proneness |
| 13 | Conservativism of Temperament | Q1 | Radicalism |
| 14 | Group Adherence | Q2 | Self Sufficiency |
| 15 | Low self-sentiment integration | Q3 | High strength of self-sentiment |
| 16 | Low ergic tension | Q4 | High ergic tension |

Distribution of 16- Personality Factors Score of Male and Female Students

| S.N. | Factors | Level | Male (N=94) | | Female(N=94) | | Total | |
|---|---|---|---|---|---|---|---|---|
| | | | No. | % | No. | % | No. | % |
| 1. | A | High | 10 | 10.63 | 15 | 15.95 | 25 | 13.29 |
| | | Average | 60 | 63.82 | 33 | 35.10 | 93 | 49.46 |
| | | Low | 24 | 25.53 | 46 | 48.93 | 70 | 37.23 |
| 2. | B | High | 4 | 4.25 | 0 | 0 | 4 | 2.12 |
| | | Average | 48 | 51.06 | 19 | 20.21 | 67 | 35.63 |
| | | Low | 42 | 44.68 | 75 | 79.78 | 117 | 62.23 |
| 3. | C | High | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Average | 57 | 60.63 | 33 | 35.10 | 90 | 47.87 |
| | | Low | 37 | 39.36 | 61 | 64.89 | 98 | 52.12 |
| 4. | E | High | 3 | 3.19 | 31 | 32.97 | 34 | 18.08 |
| | | Average | 67 | 71.27 | 47 | 50 | 114 | 60.63 |
| | | Low | 24 | 25.53 | 16 | 17.02 | 40 | 21.27 |
| 5. | F | High | 0 | 0 | 10 | 10.63 | 10 | 5.31 |
| | | Average | 63 | 67.02 | 32 | 34.04 | 95 | 50.53 |
| | | Low | 31 | 64.89 | 52 | 23.40 | 83 | 44.14 |
| 6. | G | High | 13 | 13.82 | 21 | 22.34 | 34 | 18.08 |
| | | Average | 50 | 53.19 | 48 | 51.06 | 98 | 52.12 |
| | | Low | 31 | 32.97 | 25 | 26.59 | 46 | 29.78 |
| 7. | H | High | 14 | 14.89 | 35 | 37.23 | 49 | 26.06 |
| | | Average | 65 | 69.14 | 54 | 57.44 | 119 | 63.29 |
| | | Low | 15 | 15.95 | 5 | 5.31 | 20 | 10.63 |
| 8. | I | High | 49 | 52.12 | 11 | 11.70 | 60 | 31.91 |
| | | Average | 45 | 47.87 | 55 | 58.51 | 120 | 53.19 |

| | | | | | | | |
|----|----|---------|----|-------|----|-------|-------|
| | | Low | 0 | 0 | 28 | 29.78 | 28 | 14.89 |
| 9. | L | High | 33 | 35.10 | 59 | 62.76 | 92 | 48.93 |
| | | Average | 45 | 47.87 | 31 | 32.97 | 76 | 40.42 |
| | | Low | 16 | 17.02 | 4 | 4.25 | 20 | 10.63 |
| 10. | M | High | 25 | 26.59 | 32 | 34.04 | 57 | 30.31 |
| | | Average | 61 | 64.89 | 58 | 61.70 | 119 | 63.29 |
| | | Low | 8 | 8.51 | 4 | 4.25 | 12 | 6.38 |
| 11. | N | High | 73 | 77.65 | 21 | 22.34 | 94 | 50 |
| | | Average | 21 | 22.34 | 62 | 65.95 | 83 | 44.14 |
| | | Low | 0 | 0 | 11 | 11.70 | 11 | 5.85 |
| 12. | O | High | 60 | 63.82 | 70 | 74.46 | 130 | 69.14 |
| | | Average | 34 | 36.17 | 22 | 23.40 | 56 | 29.78 |
| | | Low | 0 | 0 | 2 | 2.12 | 2 | 1.06 |
| 13. | Q1 | High | 52 | 55.31 | 30 | 31.91 | 82 | 43.61 |
| | | Average | 41 | 43.61 | 54 | 57.44 | 95 | 50.53 |
| | | Low | 1 | 1.06 | 10 | 10.63 | 11 | 5.85 |
| 14. | Q2 | High | 23 | 24.46 | 19 | 20.21 | 42 | 22.34 |
| | | Average | 67 | 71.27 | 55 | 58.51 | 122 | 64.89 |
| | | Low | 4 | 4.25 | 20 | 21.27 | 24 | 12.76 |
| 15. | Q3 | High | 27 | 28.72 | 18 | 19.14 | 45 | 23.93 |
| | | Average | 65 | 69.14 | 64 | 68.04 | 129 | 68.61 |
| | | Low | 2 | 2.12 | 12 | 12.76 | 14 | 7.44 |
| 16. | Q4 | High | 15 | 15.95 | 8 | 8.51 | 23 | 12.23 |
| | | Average | 51 | 54.25 | 48 | 51.06 | 99 | 52.65 |
| | | Low | 28 | 29.78 | 38 | 40.42 | 66 | 35.10 |

## Result & Interpretation:

Table shows that the gender wise distribution of higher secondary teenage students. In this distribution 94 male and 94 female students out of 188 students are taken.

For factor A (Sizothymia/Affectothymia) only 13.29 % of students i e in Affectothymia and 37.235 i e in Sizothymia and 49.46% have average symptoms

For factor B (Intelligence) only 2.12 % of students i e in high intelligence level and 62.23% i e in low intelligence level and 35.63 % have average symptoms of intelligence.

For factor C (Ego Strength) only 52.12% of students i e in low ego strength and 47.87 % have average symptoms of ego strength and very less have high ego strength.

For factor E (Submissiveness/Dominance) only 18.08 % of students i e in dominance level and 21.27 % i e in submissiveness level and 60.63 % have average of this level.

For factor F (DE surgency/surgency) only 5.31% of students i e in surgency and 44.14 % i e in desurgency and 50.53 % have average symptoms of these. For factor G (Expedients/Conscientious) only 18.08 % of students i e in stronger superego strength and 29.78 % i e in weaker superego strength and 52.12 % have average superego strength

For factor H (Threctia/Parmia) only 26.06% of students i e in parmia and 10.63 % i e in threctia and 63.29    % have average symptoms of these.

For factor I (Harria/Premsia) only 31.91 % of students i e in premia and 14.89% i e in harria and 53.19    % have average symptoms of these factors.

For factor L (Alaxia/ Pretension) only    48.93 % of students i e in pretension   and 10.63 % i e in alaxia and   48.93 % have average symptoms of these.

 For factor M (Praxernia/Autia) only 30.31 % of students i e in autia and    6.38    % i e in praxernia and 63.29 % have average symptoms pf autia and praxernia

For factor N   only 50   % of students i e in shrewdness and   5.85     % i e in Artlessness and 44.14 % have average symptoms to these factors.

For factor O (Untroubled adequacy/Guilt Proneness) only 69.14 % of students i e in guilt proneness and 1.06 % i e in   untroubled adequacy a 29.78 % have average symptoms

For factor Q1 (Conservation of Temperament/Radicalism) only 43.61 % of students i e in radicalism and 5.85 % i e in conservativism of temperament and    50.53 % have average symptoms of these.

For factor Q2 (Group Adherence/Self-sufficiency) only    22.34 % of students i e in self-sufficiency and 12.76 % i e in group adherence and 64.89 % have average symptoms of these

For factor Q3 (Self-sentiment Integration) only 23.93 % of students i e in high strength of self-sentiment   and 7.44 % i e in low strength of self-sentiment and   68.61 % have average of these

For factor Q4 (Ergic tension) only   12.23 % of students i e in high ergic tension   and   35.10 % i e in   low ergic tension and     52.65 % have average symptoms of these.

 ANOVA of Social skills score among students having different orientation of 16 – PFs

| S.N. | 16 - P F s | Between/ Within Group | SS | D.F. | MS | F |
|------|-----------|----------------------|-----|------|-----|---|
| 1 | A | Between Group | 861.01 | 2 | 430.50 | 1.71 |
|   |   | Within Group | 46502.81 | 185 | 251.36 | |
| 2 | B | Between Group | 8907.28 | 2 | 4453.64 | 21.42 ** |
|   |   | Within Group | 38456.54 | 185 | 207.87 | |
| 3 | C | Between Group | 764.66 | 1 | 746.66 | 3.01* |
|   |   | Within Group | 46599.16 | 186 | 250.53 | |
| 4 | E | Between Group | 1216.91 | 2 | 608.45 | 2.44 |
|   |   | Within Group | 46181.48 | 185 | 249.62 | |
| 5 | F | Between Group | 3369.43 | 2 | 1684.71 | 7.08** |
|   |   | Within Group | 43994.39 | 185 | 237.80 | |
| 6 | G | Between Group | 62.53 | 2 | 31.26 | 0.12 |
|   |   | Within Group | 47335.86 | 185 | 255.86 | |
| 7 | H | Between Group | 2093.10 | 2 | 1046.55 | 4.27** |
|   |   | Within Group | 45305.29 | 185 | 244.89 | |
| 8 | I | Between Group | 386.35 | 2 | 193.17 | 0.76 |

| | | Within Group | 47012.05 | 185 | 254 | |
|---|---|---|---|---|---|---|
| 9 | L | Between Group | 1765.11 | 2 | 882.55 | 3.58* |
| | | Within Group | 45633.29 | 185 | 246.66 | |
| 10 | M | Between Group | 1426.21 | 2 | 713.10 | 2.87 |
| | | Within Group | 45972.18 | 185 | 248.49 | |
| 11 | N | Between Group | 3389.36 | 2 | 1694.68 | 7.12** |
| | | Within Group | 44009.03 | 185 | 237.88 | |
| 12 | O | Between Group | 1659.99 | 2 | 829.89 | 3.36* |
| | | Within Group | 45738.60 | 185 | 247.23 | |
| 13 | Q1 | Between Group | 848.18 | 2 | 424.09 | 1.69 |
| | | Within Group | 46550.21 | 185 | 251.62 | |
| 14 | Q2 | Between Group | 5147.75 | 2 | 2573.87 | 11.27** |
| | | Within Group | 42250.64 | 185 | 228.38 | |
| 15 | Q3 | Between Group | 239.62 | 2 | 119.81 | 0.47 |
| | | Within Group | 47158.77 | 185 | 254.91 | |
| 16 | Q4 | Between Group | 5302.84 | 2 | 2651.42 | 11.65** |
| | | Within Group | 42095.55 | 185 | 227.54 | |

\* Significant
\*\* Highly Significant

Internal Comparison of Social skills & Ratings Skills among students having different orientation of P. Fs.

Post – Hoc T - test after ANOVA

| S.N, | Factors | High vs Average | | Average vs Low | | Low vs High | |
|---|---|---|---|---|---|---|---|
| | | Mean Diff. | T – value | Mean Diff. | T – value | Mean Diff. | T – Value |
| 1 | B | 19.39 | 2.45* | 12.3 | 4.56** | 31.64 | 4.59** |
| 2 | F | 1.91 | 0.40 | 8.02 | 3.37** | 6.11 | 1.15 |
| 3 | H | 2.16 | 0.83 | 9.76 | 2.42* | 11.92 | 3.15** |
| 4 | N | 8.42 | 3.62** | 0.64 | 0.13 | 9.06 | 1.80 |
| 5 | Q2 | 3.38 | 1.25 | 14.26 | 4.22** | 17.64 | 4.63** |
| 6 | Q4 | 9.28 | 2.43* | 7.54 | 3.14** | 16.82 | 5.40** |

\* Significant
\*\* Highly Significance

Result, interpretation and Discussion: Table clearly show that mean scores of high and average intelligence students are 333.5 and 352.89 and t value is 2.45. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and not significant at 1 % level of significance. The result clearly depicts that the high and average intelligent students 'social skills have a partially difference. For average and low intelligent students mean value

are 352.89 and 365.19 and t value is 4.56. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and 0.01 level of significance. The result clearly depict that the low and average intelligent students' social skills have a significant difference. For low and high intelligent students mean value are 365.19 and 333.5 and t value is 4.59. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and 0.01 level of significance. The result clearly depict that the low and high intelligent students' social skills have a significant difference.

For high and average DE surgency/surgency students mean value are 358.4and 356.4 and t value is 0.40. Hence it is clear that difference between the mean of them is not significant at 0.05 level of significance and 0.01 level of significance. The result clearly depicts that high and average DE surgency and surgency students' social skills have no significant difference. For average and low desurgency/surgency students mean value are 356.4 and 364.51 and t value is 3.37. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and 0.01 level of significance. The result clearly depicts that average and low desurgency and surgency students' social skills have a significant difference. For low and high desurgency/surgency students mean value are 364.51 and 358.4 and t value is 1.15. Hence it is clear that difference between the mean of them is not significant at 0.05 level of significance and 0.01 level of significance. The result clearly depicts that low and high desurgency and surgency students' social skills have no significant difference.

Table clearly show that mean scores of high and average threctia / permia students are 362.77 and 360.61 and t value is 0.83. Hence it is clear that difference between the mean of them is not significant at 0.05 level of significance and not significant at 1 % level of significance. The result clearly depicts that the high and average threctia and permia students 'social skills have no significant difference. For mean scores of average and low threctia / permia students are 360.61 and 350.85 and t value is 2.42 Hence it is clear that difference between the mean of them it is significant at 5% level of significance and not significant at 1 % level of significance. The result clearly depicts that average and low threctia and permia students'social skills have a partially significant difference. For mean scores of low and high threctia / permia students are 350.85 and 362.77 and t value is 3.15. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and not significant at 1 % level of significance. The result clearly depicts that the high and low threctia and permia students 'social skills have a significant difference.

Table – clearly show that mean scores of high and average Artlessness/shrewdness students are 355.89 and 364.26 and t value is 3.62. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and significant at 1 % level of significance. The result clearly depicts that the high and average Artlessness/shrewdness students 'social skills have a significant difference. For mean scores of average and low Artlessness/shrewdness students are 364.26 and 364.90 and t value is 0.13. Hence it is clear that difference between the mean of them is not significant at 0.05 level of significance and significant at 1 % level of significance. The result clearly depicts that the low and average Artlessness/shrewdness students 'social skills have no significant difference. mean scores of low and high Artlessness/shrewdness students are 364.90 and 355.89 and t value is 1.80. Hence it is clear that difference between the mean of them is not significant at 0.05 level of significance and significant at 1 % level of significance. The result clearly depicts that the low and high Artlessness/shrewdness students 'social skills have no significant difference.

Table clearly show that mean scores of high and average group adherence and self-sufficiency students 355.69 and 359.07 and t value is 1.25. Hence it is clear that difference between the mean of them is not significant at 0.05 level of significance and not significant at 1 % level of significance. The result clearly depicts that the high and average group adherence and self-sufficiency students 'social skills have no significant difference. mean scores of average and low group adherence and self-sufficiency students are 359.07 and 373.33 and t value is 4.22. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and not significant at 1 % level of significance. The result clearly depicts that the average and low group adherence and self-sufficiency students 'social skills have a significant difference. mean scores of low and high group adherence and self-sufficiency students are 373.33 and 355.69 and t value is 4.63. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and not significant at 1 % level of significance. The result clearly depicts that the low and high group adherence and self-sufficiency students 'social skills have a significant difference.

Table – clearly show that mean scores of high and average eric tension students are 349.34 and 358.62 and t value is 2.43. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and not significant at 1 % level of significance. The result clearly depicts that the high and average ergic tension students 'social skills have a partially significance difference. mean scores of average and low ergic tension students are 358.62 and 366.16 and t value is 3.44. Hence it is clear that difference between the mean of

them it is significant at 5% level of significance and 0.01 level of significance. The result clearly depicts that the average and low ergic tension students 'social skills have a significance difference. mean scores of low and high ergic tension students are 366.16 and 349.34 and t value is 5.40. Hence it is clear that difference between the mean of them it is significant at 5% level of significance and 0.01 level of significance. The result clearly depicts that the low and high ergic tension students 'social skills have a significance difference

**Hypotheses Testing**

Hypotheses – 1

There is no significant relationship between the social skills and Personality Factors of higher secondary school students.

After analysis of collected data, it is found that a significant relationship is fond between social skills and personality factors on the basis of gender, school types and family types

Hypotheses- 2

There is no significant effect of personality factor on social skills of higher secondary schools' students.

It is found that personality factors affect the social skills on the basis of gender, school types and family types.

**Conclusion**

**Educational Implications**

The finding of this research to assist teachers in adjusting their teaching method in order to make learning more effective and students cantered. The result of the research also helps to students in improve their social skills and refine their personality. It will help the students in choosing their career path according to their interests and to understand their tendencies. Guidance and counselling are very easy on the bases of their interest areas. This study will help teachers to know the strength This study will help teachers to know the strength and weakness of the students and help teachers to choose method for effective teaching and learning. This study also supports to teacher to create the holistic profile of each student, due to that teachers can easily asses the continuous and comprehensive evaluation of the students. This research will also support to implement the New Education policy – 2020, with the help of this study teacher will know how, the social skills change with personality factors?

**Recommendation and Suggestions**

Present study was conducted only on District level. In future we will conduct study on state as well as international level. In the present study researcher took only 188 higher secondary school students due to shortage of time and resources. in future we will conduct this research on large sample size. Only two variables were taken social skills and Personality Factors in this study, we will also take more dimensions of social skills for examples empathy, interpersonal skills, emotions of social welfare. With the help of this study, we can understand more deeply about the, thinking style, emotions cognitive mind, structure of social interactions of Children with disabled.

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# Transformational Changes in School Education through STEM in School of Specialized Excellence (SoSEs) Delhi: An Exploratory Study

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**Abstract**

**Objective:** Science, technology, engineering, and mathematics (STEM) education transformed Indian schools. This comprehensive new initiative of the Delhi Government gives students technocratic-meritocratic skills and knowledge. Breaking gender stereotypes creates an inclusive environment where girls feel supported and encouraged to pursue STEM careers. This article examines SoSE STEM students' perceptions of STEM learning and VMC support. **Methods:** On 22 March 2021, DOE Delhi opened SoSEs with world-class facilities and IB curriculum as per NEP 2020. All SoSEs include core learning levels, while higher levels specialise in STEM, humanities, performing and visual arts, high-end 21st-century skills, and armed forces preparatory school. SoSEs receive academic support from Vidya Mandir Classes, well-known for its engineering and medical entrance exam preparation programmes. The 75 SoSE (STEM) students and 15 teachers provided data via questionnaires and semi-structured interviews. Observation of classes 9th to 12th has done to explore how integrating online VMC programmes with regular school education affects school culture and teachers' enthusiasm to teach science stream subjects. Additionally, how SoSE (STEM) students balance their usual and online VMC academic schedules. **Results:** The study revealed that students had access to digital devices and well-equipped science laboratories. STEM activities in SoSE schools challenged gender and subject-based stereotypes while enhancing awareness of STEM-related career options. Students demonstrated intellectual readiness for diverse fields, including NEET, IIT-JEE, nursing, etc. They transitioned from rote learning to a deeper, conceptual understanding. Their problem-solving abilities improved through activities such as building robots and classroom tools. **Conclusions** Despite these gains, students faced difficulty aligning their regular board curriculum with the competitive demands of VMC classes. The VMC's online format required high levels of self-discipline and motivation, yet lacked the benefits of face-to-face teacher support, limiting interaction and personalized guidance.

**Keywords:** STEM, SoSEs, VMC as a Supplementary Support, Transformational Change

**Introduction**

India, worldwide, forory in the fields of science and mathematics (Manges currently) are currently facing a shortage of science, technology, engineering, and mathematics (STEM) majors and graduates (NASSCOM Survey 2020). Inadequate emphasis on science and maths education in our educational system has, unfortunately, resulted in students gradually losing interest over the decades. While at the same time, STEM occupations are expected to grow (Langdon et al., 2011; U.S. Bureau of Labor Statistics, 2018; NEP, 2020). This two-fold issue necessitates that STEM education in India becomes and remains a priority. According to the National Education Policy (2020), this priority must include broadening students' participation in STEM and increasing STEM literacy for all students, regardless of whether they plan to pursue a STEM major or career. Informal learning environments have been shown to improve students' interest in STEM (Mohr-Schroeder et al., 2014) and have been shown to increase the chances a student will pursue a STEM career (Kitchen et al., 2018; Kong et al., 2014). According to (Bell et al., 2009), interest and motivation are crucial factors in encouraging students to pursue STEM education because they help them learn and successfully retain STEM material. The world is rapidly changing in response to AICTE and NEP (2020). Machines may take over many unskilled jobs, and a skilled workforce will be needed. This could significantly increase the number of people working in data science and other fields, such as STEM. The number of STEM jobs is growing at the fastest rate in India. People, Policy Makers, and Educational Societies need to create a conducive environment to avail the opportunity and benefits of STEM Ashutosh (2021).

In India, most students have concluded that STEM subjects are too challenging, complex, boring, and uninteresting (K. Abdul Gafoor; Abidha Kurukkan, 2015), limiting their participation in STEM subjects and careers. Students in schools all over the world struggle with issues related to educational quality. One of the primary objectives (Goal 4) listed by the United Nations (UN) in its Sustainable Development Goals is quality education (SDGs). In India, several obstacles exist in terms of accessibility, fairness, and quality standards, including the shortage of instructors, inadequate infrastructure, a lack of regular teachers who are enthusiastic about their jobs, and others. Central Govt. initiatives under CSR and the Ministry of Science, like Atal tinkering Lab (2016), Robo Shiksha Kendra, Tinkering Lab, Blended Lab, and Future Leaders Lab, were initiated to promote STEM, including participation in Gin Initiatives. Initiatives like the Department of Science and Technology were created to inspire girls to seek higher education and careers in STEM sectors. The Delhi Government has

undertaken several efforts in the last decade to provide excellent education in schools, including the Reading Campaign, Pragati Series, Summer Camps, Mission Buniyad, Happiness Curriculum, SoEs, SoSEs (STEM) Partnership with renowned institutions and reputable National institutes like VMC, and many more. Higher secondary classes of the Delhi government schools have 57 percent female students, whereas 43 percent are in the science stream. This situation and stereotypes like boys for science and girls for humanities need to be broken now. To overcome such social stigma and stereotype beliefs, the Delhi government introduced VMC-based STEM Education to classes for students in classes 10 and 12th for NEET and JEE in SoSEs schools. Through the supplementary VMC class, the government attempted to meet the needs of parents and students from the low-income group who have the potential to excel in the classroom. There appears to be a conflict between the limited view of STEM in schools, which emphasises the more content-based domains of the subjects of Science, Technology, Engineering, and Mathematics, and a wider view of STEM in the real world emerging from economic and industry policy more broadly than just in India. According to this broader perspective, STEM is "a point of discontinuity, of society asking for a qualitative change in the objectives of education undertaken in the domain of the sciences," rather than just a collection of content knowledge in science, technology, engineering, and mathematics (LoThe students of SoSEs face some concrete issues the students of SoSEs during attending VMC So, the study intended to explore responses of SoSEs school students' towards VMC classes and STEM s jects which further influence their career goals, conceptual understanding, competition readiness, and parental satisfaction with the attainment of quality School education.

**Rationale of the Study**

The study is undertaken in the Government of NCT of Delhi School of Specialised Excellence. These schools are choice-based for grades 9 to 12, allowing students to specialise in their chosen fields of study. SwithEs are affiliated with the Delhi Board of School Education (DBSE). Their design adheres to the DBSE concept, which emphasises the need to move away from rote memorization by including assessments into regular teaching-learning activities and utilising them as tools for learning. DBSE has partnered with IB to match up to international standards. These schools have good infrastructure and learning teachers suited to teach a new-age curriculum with high technological assistance. The admission is based on an aptitude test and assessment in the specialised domains.

Students have the opportunity for experiential learning through projects, field visits, internships, etc., in their chosen field of interest, and also have the opportunity to learn foreign languages. The society has a positive outlook towards SoSEs and possesses a favourable cultural milieu for protecting the environment. However, despite several positive traits in students, there is a prevalent negative phobia also noted towards science subjects in these schools. Research reported that, in the Indian context, fewer students choose the science stream at the senior secondary level than the humanities. In Indian Society, there are stereotypes that boys are made for choosing science and maths, while girls are ok with humanities. Therefore, the question arises in the researcher's mind: How do SoSE schools break this stereotype and provide opportunities for girls to pursue their careers in STEM education? How SoSEs address the needs of science learners. Why do most STEM students find it challenging to compete in exams even if they have the support of VMC? Do teachers of SoSEs provide career counselling services to students? How do mainstream teachers interact with students during Vidya Mandir classes?

There is a strong need to explore the available discourse and education facilities in the schools. The nature of initiatives taken by students in schools needs to be explored, as well as how they are being prepared for careers in science, technology, engineering, and mathematics. STEM initiatives must be understood to make necessary amendments in the nation's ways. Therefore, the present study attempts to examine the responses of students enrolled in STEM schools towards perceived STEM learning experiences and improvement of VMC in SoSEs.

**Research Questions**

Based on the rationale of the present study, the following research questions were framed.

1. What resources and support systems are available in SoSEs to carry out VMC classes?
2. What are the effects of VMC classes on the learner's career aspiration, conceptual understanding, and competition preparedness regarding quality school education?
3. How do students balance the curriculum, including regular common subjects and specialized subjects?
4. What are the concrete issues, challenges, and perceptions of students related to VMC classes with a primary focus on STEM?
5. To what extent are parents satisfied with "VMC Classes" in the context of STEM education?

**Objective of the Study**

- To explore the availability of resources and support systems in the School of Delhi.

- To study the effects of VMC class on the learners' aspiration, conceptual understanding, competition preparedness, and their parental satisfaction regarding quality school education

- To explore the concrete issues, challenges, and perceptions of students related to VMC classes with a primary focus on STEM

- To know the parental satisfaction regarding STEM in the SoSE school and VMC class.

**Methodology**

According to Creswell (2012), qualitative research is a means for exploring and understanding the meaning individuals or groups ascribe to a social human problem. So the researcher used a qualitative approach to descriptive research. Creswell (1994) stated that the descriptive research method gathers information about existing conditions. The sample of 75 Students was selected through purposive sampling from six SoSEs (*SoSEs Kalkaji, SoSEs Rohini Sec-18, SoSEs Civil Lines, SoSEs INA Colony, SoSEs Karol Bagh, and SoSEs Khichripur*) from the STEM field of the Delhi region were chosen as a sample by the researchers. These schools cover students in grades IX through XII. Grades IX and X focus on foundational learning with specialized instruction in Science and Mathematics.

In contrast, grades XI and XII offer a better understanding of STEM subjects, with the option of majoring in engineering or medicine. The subjective data from students' personal experiences and shared instances was also gathered with the help of semi-structured interviews with 18 students of classes XI and XII from various STEM SoSEs. These SoSEs aimed to establish the school as a School of Excellence, complete with the best teaching and learning techniques for STEM education. A questionnaire with 10 questions about the various aspects of VMC, namely the effect of VMC class on the learner's career aspiration, conceptual understanding, competition preparedness, and parental satisfaction regarding quality school, availability of resources, and the teaching-learning process, was developed by the researcher to collect the data. A total of 6 VMC classrooms of NEET and JEE classes XI and XII (1 observation was kept from each school) were observed in physical mode between July 2024 and September 2024. The objective of this study and the instructions about the questionnaire were spelled out to the sample. The questionnaire was circulated to the students physically, and the collected data were then analyzed for further interpretation.

**Findings and Discussion**

The findings and discussion of this study are explained based on the following aspects such as resources and support systems available in SoSEs to carry out VMC classes, effects of VMC

class on the learner's career aspiration, conceptual understanding, competition preparedness and their parental satisfaction regarding quality school education, students perception related to "SoSEs" and "VMC Classes" in the context of STEM education, and various issues, challenges.

**Availability of Resources and Support System in the SoSE school in Delhi to carry out VMC classes.**

Educational resources play a pivotal role in achieving educational objectives and goals globally. The degree to which an educational institution accomplishes its objectives is directly linked to the availability of educational resources and how effectively they are used (Ekundayo & Alonge, 2012). Consequently, the interaction between inherent qualities and environmental factors affecting the quality of education and the productivity of staff members is a crucial concern that demands the attention of stakeholders in the education sector. Adopting flexible learning resources (Cutter, S.et al, 2010) is vital for shifting from a knowledge-focused learning culture to establishing a dynamic STEM education approach.
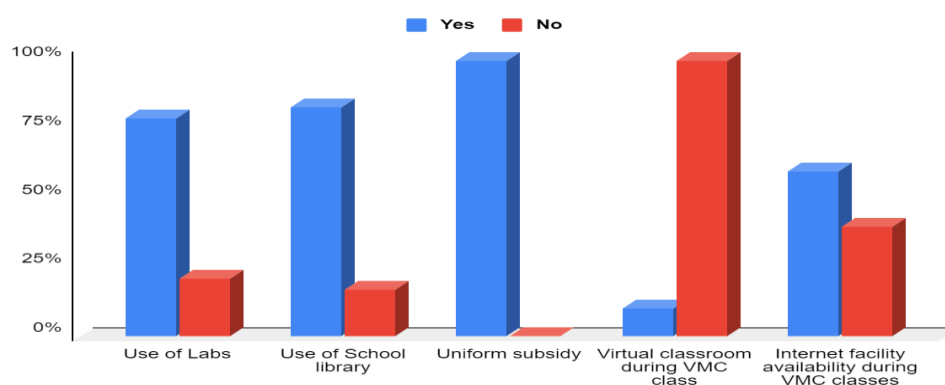


Educational facilities are tools or materials used to facilitate achieving goals. Graph 1 above shows the responses on the availability of school facilities and the support system needed for teaching and learning concerning STEM subjects and VMC classes. Results from this table revealed that most of the respondents, 79% of the students, agree that they use the science lab for practical work. They get the chance, whereas 21% of the stakeholders stated, "*Sometimes we hardly get the chance as we have insufficient time and the period gets over as we also have VMC class from 11.30 after the regular class*". 83% of the students stated that they use the school library and the books on different subjects and topics were available to them as one of the students stated "*There are enough suitable resources to support my STEM activity designs. Sometimes STEM activities require teaching outdoors, which help us to prepare suitable and related learning resources.*" Students have been provided financial assistance by the Delhi government to achieve academic excellence as every student who is enrolled in SoSEs get help

by providing them with a subsidy for school uniforms etc. Most SoSE students seemed critical when asked about the VMC class, which is carried out in virtual mode. There was a negative response from the respondents, as during the VMC class, there was no two-sided interaction between the teachers and students, because, as passive listeners, the class was not so effective and engaging. 60% of the respondents stated that the internet facility is available. However, the speed tends to decrease due to numerous concurrent connections, resulting in frequent disruptions during their IIT JEE and NEET classes.

During the researcher's classroom observations in SoSEs, it was noted that the classrooms were well-maintained and created an engaging atmosphere. The classroom setup, including smart boards in 11th and 12th-grade classes, was designed to facilitate an environment conducive to STEM learning. However, it is important to recognize that teachers and students' effective utilization of these resources plays a pivotal role in determining the ultimate educational outcomes. As per Owoko (2010), the concept of resources encompasses not solely teaching methods and materials but also includes the allocation of instructional time, along with the expertise and competencies of teachers acquired through their training and practical experience. Given that the curriculum was unfamiliar to educators and learners, notable adjustments were made. Notably, the VMC classes continued throughout the day, except for the initial four periods before the break, during which teachers conducted lessons aligned with the Delhi Board of School Education syllabus. It is worth noting that the Delhi Government has established its educational board, the Delhi Board of School Education, in collaboration with the International Baccalaureate. In SoSEs the presence of diverse learner support mechanisms within the schools encompasses tutorial programs, peer-based learning opportunities, supplementary classes (VMC), financial aid, and the provision of educational materials to support students were provided. However, there is a need for proper management of schools such as planning, organizing, directing, controlling, staffing, evaluating, establishing criteria, and executing other managerial functions related to the essential components comprising the learner support system.

**Teaching Learning Process**

Success in the teaching-learning process depends on the interest and motivation of the students (J.B. Deesha, 2022). It is the teacher's responsibility to ensure regular interaction occurs between the basic human capabilities of a learner and the culturally invented technologies so that it finally leads to enhancement in their cognitive capabilities (Afzal & Kalam, 2021). A 21st-century teaching and learning approach to STEM is one of the cornerstones of effective

learning. Integrating STEM can be challenging since it requires a new generation of STEM experts. STEM education should include problem-solving, critical thinking, creative thinking, and scientific thinking components to help students enhance their higher-order thinking skills (Baharin, 2018). The teaching and learning dynamics at SoSEs struggled to capture students' interest due to the demanding schedule and the added workload on teachers, which hindered their ability to perform at their best during instruction. Students were overwhelmed with homework from the DBSE syllabus, as they were still adapting to the new IB curriculum and the assignments from VMC classes. Furthermore, teachers at SoSEs had considerably longer working hours than their counterparts in other Delhi government schools.
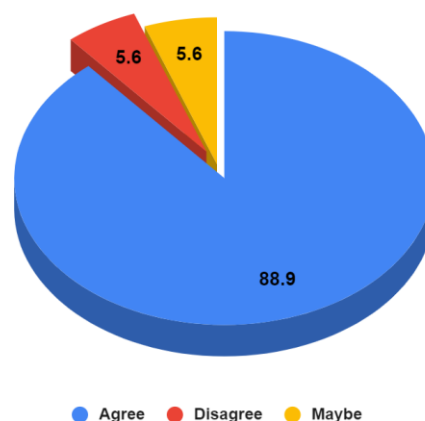
The above pie chart depicts that nearly 89% of the teachers agreed that the regular class related to STEM lacks a high level of engagement. One of the teachers stated that "*we are focusing on students to crack the IIT JEE and NEET entrance. We are overburdened with our jobs. We do not get any extra time to focus on preparing Video lectures or PPTs to teach in classes, as SoSEs is a model school of the Delhi government, one or the other activities regularly happen in our school, and we are busy attending the guest or other extra programmes. Besides this, the VMC classes affect the regular school process. We get very few lectures to teach in class, and must also be present as an attendant during the VMC class.*"

Based on the feedback from teachers and classroom observations, it can be deduced that the government's vision for the school includes top-notch infrastructure and supplementary coaching classes to prepare students for entrance exams such as NEET, JEE, and other science-related examinations, both in the medical and non-medical domains. The government aims to equip the school with the necessary tools to foster excellence in STEM education and ensure that students are well-prepared to excel in competitive entrance exams. While the outcome envisioned with the provided infrastructure is that of a quality workforce in the field of STEM,

the product depends on the process of using the provided resources. It is upon schools and teachers to decide how they best use the resources to complement their teaching and learning and how they implement them in their pedagogies. (Krajcik and Delen, 2017) Teachers need to incorporate scaffolds to support students in becoming familiar with STEM-related subjects.

**Enhancing Computational Thinking among Students in SoSEs**

Expanding upon the importance of enhancing conceptual understanding and knowledge building through supplementary classes, it is crucial to recognize that these efforts contribute significantly to fostering "Computational thinking" among students. "Computational thinking" is a foundational competence encompassing problem definition, problem resolution, and scientific rationale (Wing, 2006). Additionally, CT constitutes a metacognitive procedure encompassing sub-skills and predispositions for overseeing intricate problem-solving and creating models for phenomena that may not be directly observable (Dwyer et al., 2014). It enhances science education and elevates student involvement in STEM learning by integrating computational thinking into scientific inquiry, as suggested by Yang et al. (2018).
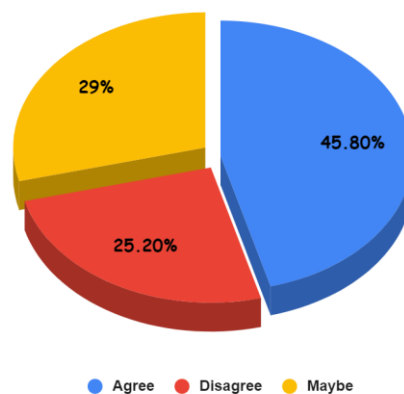


Among the responses received, 46% of the students agreeds schools, different subject classes assist them in gaining metacognitive process that involves sub-skills and dispositions for regulating complex problem-solving and modeling unobservable phenomena of STEM concepts. Conversely, approximately 25% of the students held a differing viewpoint. Although the majority of research (Bicer et al., 2015) on the mathematical thinking and scientific reasoning abilities of secondary students, has focused on the cultivation of computational thinking skills in secondary students (Lye & Koh, 2014).

The students' verbatims was as follows: *"We are only focusing on the concepts related to IIT JEE and NEET exams to clear the important exam"*. "*The quality of STEM learning varies greatly. Some teachers are excellent, so they teach very well, but time constraints sometimes*

*hinder them from delivering their best.*" 29% of the students were not sure about the knowledge building and understanding concepts, as they stated that "*to some extent it is clear, but not all. We learn theories, but practical application is limited, and hands-on experience in STEM is lacking due to time constraints.*

The verbatim responses provided above shed light on the intricate nature of STEM learning within the SoSEs environment. Through classroom observations and interviews with teachers, it became evident that the educational landscape in these schools is characterized by certain limitations, most notably, constraints on available time. However, despite these challenges, the teachers diligently try to provide the highest quality education possible. They strive to deliver their best within the constraints they face, ensuring that students receive a valuable and enriching educational experience. Incorporating computational thinking into the educational setting aids in equipping students for the future by fostering creativity and enhancing problem-solving skills, as noted by Fessakis et al. (2013).

**Competition Preparedness or competency-based VMC class about STEM.**

STEM is an initiative to encourage more students to pursue degrees in science, technology, engineering, and mathematics so that their nations may remain competitive and avoid falling behind other nations (Herschbach, 2011; Kelley & Knowles, 2016). 21st-century problems need STEM skills and competencies more than ever. Currently, we are at a stage where the number of STEM employment is expanding quickly and surpassing the number of STEM graduates. The National Science Foundation predicts that 80% of the occupations expected to be created in the upcoming ten years will require a large amount of maths and science expertise.
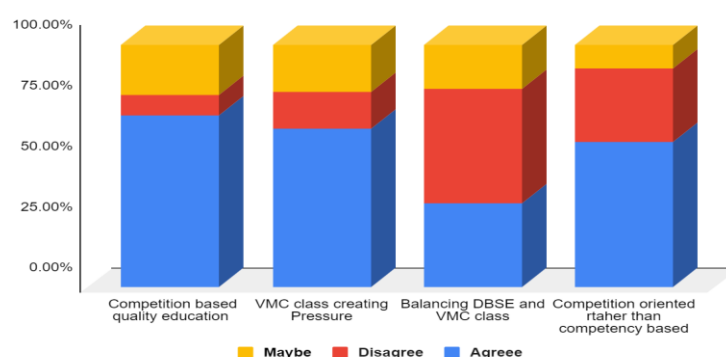


The above graph reveals that 70.80% of the stakeholders agreed with the statement that that VMC classes are trying to provide competition-based quality education. They have not only designed, delivered, innovated, and perfected the art of teaching, but have also guided and helped their students to realize their dreams, as in SoSEs schools, it is a way to communicate video lectures with the recorded class. The constraints of students here arethat  they are

passively attending the class with one school teacher as an attendant. The VMC class focuses on the content that will help clear the entrance to JEE, NEET, and other medical and engineering exams. 65.30% of the respondents stated that VMC classes create pressure among students as they have to attend those online recorded classes with no interaction compulsorily, they also have to complete the assignments, give tests every weekend, and study the DBSE syllabus. Only 30.70% of the respondents agree that SoSEs are efficiently and effectively balance DBSE mainstream education and VMC classes. 75% of the students agreed with the statement and stated that VMC classes are more competition-oriented rather than competency-based because they only focus on marks and not quality.

**SoSEs Learners Career Aspiration and the role of VMC class concerning STEM**

Middle school children who value science are likelier to choose a STEM career (Tai et al., 2006). The development of the STEM workforce is crucial, but it is also crucial that our citizens acquire scientific and technological literacy (Milner et al., 2012). Career goals play a significant role in shaping an individual's study behavior in any higher education setting because they motivate the individual to achieve academic excellence. Lopez-Bonilla et al. (2012) identified that career aspirations are the most common motivations for course or programme completion.
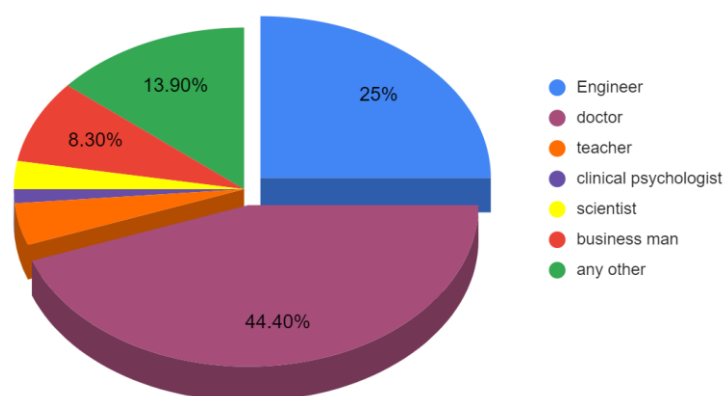


The above data reveals that entrepreneurship was the most emphasized career pathway amongst SoSE students besides the medical and engineering. Participants also raised their career choice into neuroscience, science, game development, and program development. A few boys expressed their career choice as a nurse, and only a very few students stated that they wish to be a teacher. Doctors (44.40%) and Engineers (25%) are some among the most liked careers.

Looking at the above data, there is a need for periodic career guidance seminars for students who are enrolled in SoSEs, especially VMC students, throughout their studies to stimulate career awareness and also nurture their enthusiasm to study for positive results.

**Parental satisfaction regarding the quality of the school**

Almost all the parents believed that the Delhi government is doing a commendable job of bringing overall improvement in the school education, as every parent wants schools with a good number of facilities in their area. The responses revealed that most parents appreciated the focus of government schools' focus on improving education and holistic development of children, unlike their private counterparts, concerned with increasing the fees and focused on extracurricular activities. The changing image of Delhi government schools has encouraged many parents to prepare their students to crack entrance to enrol in SoSE schools. The graph depicts that most of the parents' Qualification is class 10 and 12, and these SOS schools are helping low-middle-class income parents by keeping their wards directed towards quality competitive education.
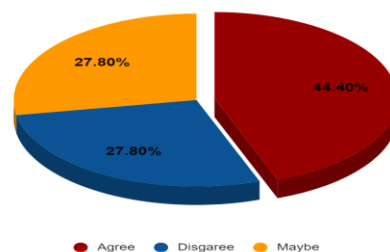


44.40% of the parents' desires and needs are satisfied related to education. Whereas 27.80% of the parents are concerned about their ward's studies as they think that almost all the study in school is through VMC and teachers have little to share about students' regular assessments. After all these initiatives, the students have to attend various other compulsory activities regarding the deshbhakti curriculum and hobby hubs, which leaves them with less time to focus on what they want to do.

*Students' perceptions and concerns related to "SoSEs" and "VMC Classes" in the context of STEM education:*

The structured interview was scheduled and reviewed based on the students' comments. The result was based on the responses to all five items by the six SoSE school Science stream students of Delhi government schools and presented in tabular form in Table 1.

*Table 1: Interview summary of SoSEs Delhi Government School Students*

| 3 Students from each SoSE | How is SoSE different from other Delhi | What specific skills do SoSEs | Does VMC provide creative | How do you manage | How do SoSEs and VMC classes |
|---|---|---|---|---|---|

| | | Government schools | possess? | or hands-on teaching? | regular exam studies and VMC preparation? | help you in attaining your goals? |
|---|---|---|---|---|---|---|
| 1. Students of SoSE Kalkaji | Student 1- <br> Student 2- <br> Student 3- | Targeted career pathways. <br> VMC classes <br> STEM learning | Competitiveness. Engage in solving problems. Problem solving. | Focus only on the Entrance exam. <br> Video lectures. <br> To crackthe entrance | Regular 08.00 am to 11.30 am and VMc 11.30 to 3 pm <br> No extra time | We aim to become a Doctor or Engineer, and VMC will aid Crackthe entrance exams. |
| 2. Students of SoSEs Rohini Sec-18 | Student 1- <br> Student 2- <br> Student 3- | One-day Exam preparation. <br> IIT and JEE exams <br> Infrastructure | No such skills, <br> Experiments during biology class <br> No skills | Deeper understanding <br> Virtual classes <br> Concept clearing | All day busy <br> Study the whole day in school and after school, Homework. | W,e as Students, got an environment in which we can prepare for competitive examinations systematically and comprehensively. |
| 3. Students of SoSE Civil Lines | Student 1- <br> Student 2- <br> Student 3- | Domain of Specialisation <br> Experienced teachers <br> One-day Exam preparation | building skills such as solving problems, logical reasoning, <br> No skills | Prepare for competitive examinations. <br> No interaction <br> Passive learning | Attend school till 3.00 pm, reach home by 4 to 4.3 pm0 No rest. Completing school task | SoSEs give Students rigorous training, helping to develop a deeper and better understanding of concepts of STEM subjects. |
| 4. Students of SoSEs, INA Colony | Student 1- <br> Student 2- <br> Student 3- | Career Pathways <br> Crack Entrance. <br> Talented Students | Problem-solving. | Focus ionmedical and engineering. <br> Video classes Comprehensive | Time and study management are issues | VMC helps us to clear concepts related to the IIT and JEE exams |
| 5. Students of SoSE Karol Bagh | Student 1- <br> Student 2- <br> Student 3- | Allow to Learn skills. <br> World-class Infrastructure <br> Top faculties | No Holistic growth. <br> No skills. <br> To crack the exams | No creativity <br> Only Virtual class <br> Entrance exam oriented. | Tense about preparation and no time to study for exams. <br> Focus only on passing exams. | SoSEs with no cost provide a competitive environment for students with a weaker economic background to reach their goal.. |
| 6. Students of SoSE Khichripur | Student 1- <br> Student 2- <br> Student 3- | International Curriculum <br> Experiential learning. <br> DBSE Board. | Subject-based Experiments, <br> No skills <br> Some skills, like critical thinking | In a systematic and comprehensive way. <br> Focus on IIT and JEE. <br> Video lectures | Due to time issues, we skip school many times during exams. <br> Lots of Burden. | We are getting VMC coaching free of cost with world-classs infrastructure to crack the entrance of IIT and JEE. |

Participant observation was another tool used to gain deeper insight. The researcher closely observed the schools and the interviews to get the complete picture (beyond what was verbally communicated). Field notes were kept, and any important observation or detail for the research was noted.

In the *first item* of the interview schedule, they were asked the Students about how SoSEs are different from other Delhi Government schools, and most of the Students (40%) summarised it that Schools of Specialized Excellence are choice-based schools for grades 9 to 12 that allow students to specialize in their chosen fields of study. Students are prepared for targeted and

aspirational career pathways, which help them crack entrance exams like IIT JEE and NETT. (20%) said that its focus is on targeted career pathways in different specializations such as Science, Technology, Engineering, and Mathematics (STEM), Humanities, High-End 21st Century Skills, Performing and Visual Arts, and Armed Forces Preparatory School. Most participants agreed that it runs VMC classes, which help clear the exams in different domains. (90) % of the students stated, "*SoSE schools have world-class infrastructure for educating us. It allows us to learn many different skills related to STEM, and the faculty is also excellent as compared to other schools.*" The majority of the students also stated that *"we get to study the International IB curriculum with no cost, which other schools will not provide., In SoSEs, we aim to provide experiential learning with the CBSE board."*

During the researcher's visits to the six different SoSEs, it was found that the school has ICT facilities available, which will bridge the divide between urban and rural schools, where information is only a fingertip away. It has a well-maintained building with an immersive environment. The walls are covered with informative prints, creating an immersive and inductive STEM environment. In SoSE classrooms, blended learning could be observed as the students interacted with the instructors or teachers and the learning materials in offline classes in schoo,l and through online mode in Vidyamandir classes.

From the above observations, the government has envisioned the school functioning with a high-quality infrastructure, including the additional coaching classes for preparing entrance exams like NEET, JEE, and other medical and nonmedical science-related exams.

The *second item* was to study the specific skills possessed by SoSEs. (30%) of the stakeholders said that SoSEs possess problem-solvinglls sucd (20%) said that s/he know different skills such as competitiveness and expertise in subjects of PCMB. (10%) of the students stated that they learn critical thinking skills auring STEM subjects, as some of the teachers do probing and brainstorming of the concepts and questions. Conversely, 40% of the students expressed a different perspective *"We have not acquired any such skills as we just have to focus on studies of school syllabus and then VMC class after the home assignments we also have to go for tuitions as IB curriculum is new to us and our schedule is such that we are not getting any time focus on ourselves"*

During the classroom observations and interaction with teachers, several noteworthy points came to light that SoSEs instill in their students a sense of competitiveness, motivating them to excel academically and professionally. It also emphasizes active engagement in problem-solving, fostering a culture where students are encouraged to tackle challenges head-on.

Problem-solving skills are a cornerstone of their educational approach. However, the researcher also observed that teachers often faced challenges due to time constraints. They were busy completing the syllabus, and their involvement in VMC coaching left them with limited time for interacting with students and equipping them with specific skills essential for holistic growth. Consequently, students may not receive ample exposure to delve into research, nurture their scientific acumen, or be encouraged to contribute to scientific innovations.

From the above observations and interactions, it can be inferred that Specialized Schools of Excellence (SoSEs) prioritize skills such as problem-solving, competitiveness, and expertise in subjects like PCMB. They aim to motivate students to excel academically and professionally, fostering a culture of active engagement with challenges. However, there is a notable challenge regarding time constraints faced by teachers, potentially limiting their ability to provide holistic skill development, including research, to students within the demanding schedule of SoSEs.

The *third item* was to know whether VMC provides creative or hands-on teaching, and the interview responses were that (70%) of the participants stated that it focuses only on cracking the entrance exam. The majority of the participants stated that *"the class is recorded in video mode and we just sit passively and listen to class if instead in case of any doubt there is no one to clear our doubt in school we have to note down and ask that questions on Sunday if they will respond then it is ok but its not possible for them to respond each query because the number queries are large."*

The researcher observed the classrooms and found that virtual classes and video lectures have become increasingly prevalent in the context of entrance exam preparation. These resources cater to students aiming to crack competitive examinations such as those for medical and engineering programs, focusing on IIT and JEE. These virtual classes aim to provide a systematic and comprehensive approach to exam readiness, emphasizing a deeper understanding of the subjects. However, it is important to note that these classes often lean towards passive learning, as there is limited interaction with teachers. Concept clearing and a thorough grasp of the necessary material are prioritized, making these virtual classes valuable for those looking to succeed in entrance exams. Nevertheless, they may not emphasize creativity or hands-on learning, as the primary goal is to equip students with the knowledge and skills required for their chosen competitive examinations through video lectures.

The *fourth item* was to know how participants manage regular exam studies and VMC preparation, The students expressed that, 80% of the participants, were unable to manage their time, and 20% said that they somehow manage with the guidance of their mentors. One of the

students expressed that *"managing regular exam studies alongside VMC preparation is extremely challenging due to our tightly packed schedule. We do not have any extra time throughout the day to refresh ourselves. We find ourselves continuously occupied with school homework and assignments, without any opportunity for rest."*

During the researcher's visits to the school, it was found that the school's timing was from 8.00 a.m. to 2.30 p.m. They had to study the regular school DBSC syllabus till 11.00 a.m., and after that they had a lunch break. After lunch, they had their VMC class to attend till 2.30 pm. Students reach home by 3.30 pm as they come from a long distance. Furthermore, they also have to go to school and do homework assignments so they hardly get any time for themselves. From the above observation and notion of the participants, it can be inferred that some of the stakeholders have experienced that the studies fully occupy their schedule, and they do not have much time to interact with the community in which they live socially. As per Delhi government Assessments, if designed effectively, they can aid in developing application, innovation, inquiry, and problem-solving skills in students. However, the above data shows that students are overburdened with the SoSE curriculum.

On the other hand, the *fifth and the last item* was to know how SoSEs and VMC classes help attaing goals. The majority of the students' responses were like *"Our primary aspiration as students in (SoSEs) is to embark on the journey to become doctors or engineers, and the invaluable support of Vidyamandir Classes (VMC) aids us in our pursuit of cracking entrance exams. Within the nurturing environment of SoSEs, we find ourselves well-equipped to prepare for competitive examinations systematically and comprehensively."* Another student stated, *"SoSEs provide us with rigorous training, enabling us to develop a deeper and more profound understanding of STEM subjects to crack the exams. Moreover, VMC coaching plays a pivotal role in clarifying concepts, but it takes too much time and sometimes they also ignoreit due to many queries. Our subject teachers could not solve our problems as they are not trained in the concepts of IIT or NEET preparations."*

In addition to this, it was observed by the investigator that the teachers were overloaded with excessive work, such as attending to guests during their visits, etc. Other teachers have to take many classes because of the scarcity of teachers who went for training due to the new curriculum in the school, such as DBSC. Teachers had an extra load to complete the syllabus on time as they had to help students succeed in the board exam. The significant aspect of SoSEs is their commitment to providing this competitive advantage to students from economically disadvantaged backgrounds, without incurring any cost. This inclusivity ensures that even

students with limited financial resources can aspire to reach their academic goals. The opportunity to receive VMC coaching, coupled with world-class infrastructure, free of cost, enhances the readiness to excel in the challenging entrance examinations for prestigious institutions like IIT and JEE.

**Conclusion**

The present paper aims to gain insight into the Students' Perceptions and Concerns towards Vidya Mandir Classes and STEM Education at the SoSEs Delhi. This study highlighted that Students have the requisite technological means for virtual education but are sceptical of the usefulness of solely online VMC lectures. Students also acknowledged the concern about the requirement for self-motivation, and the lack of direct teacher involvement to answer their questions and challenges. Students recognise the ease of virtual STEM classrooms and feel alienated, especially given their excellent skill in understanding complex concepts in science courses compared to their weekly contact with school teachers. While the government of Delhi focuses extensively on outputs, such as cracking the NEET and JEE entrance, less attention is focused on the inputs and structures of education. The result is a system that does not provide equitable access or opportunity to authentic, engaging learning experiences that bring the content to life. As the students' comments showed, their participation in the SoSEs in STEM learning experience addressed the limitations of formal schooling through the experiences provided (Bell et al., 2009; Meyers et al. 2013). Thus, in the current system, one implication of this study is the importance of high-quality STEM learning experiences to increase students' access and opportunity to engage in activities that contextualise and give purpose to their learning.

The findings of this research suggest a shift in the approach to STEM education. Students opt for in-person teaching that includes offline IIT JEE and NEET learning. This change aims to achieve the need for direct teacher-student contact. Students believe that employing an offline VMC classes approach in the SoSEs school will better prepare them for future employment options in STEM education. This strategy tackles their self-motivation concerns and guarantees that kids receive the required assistance and supervision from teachers, resulting in a more effective and engaging learning environment.

The study's consequences go beyond students' and instructors' immediate concerns, representing broader trends and issues related to technology integration in education. The need for a blended approach reminds us that, while technology is an excellent tool, human interaction and direction are still essential in the educational process. As educational institutions adjust to

the changing landscape of virtual and blended learning, it becomes increasingly important to understand and accommodate students' viewpoints and interests, thereby improving the quality of STEM education.

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# A Systematic Review of Duolingo Language-Learning Application on English Language Skills for Second Language Learners

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Available at https://omniscientmjprujournal.com

**Abstract**

This systematic literature review (SLR) synthesizes the findings of articles extracted from the literature search on using the Duolingo language learning application as a pedagogical tool for developing language skills (e.g., vocabulary, grammar, listening, speaking, reading, and writing) in English as a Second Language (ESL) and English as Foreign Language (EFL) programs. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was applied to retrieve articles by an appropriate keyword search on the Scopus and ERIC (Educational Resources Information Center) databases. Based on the inclusion/exclusion criteria and screening of texts, 19 open-access articles were identified for further contextual analysis. This study synthesizes the participant demographics, methods and methodologies of research, research design and findings. Most studies support that the Duolingo language learning application significantly improved various English language skills in second language (English) learners, such as oral communication, vocabulary, writing proficiency, etc., enrolled in various ESL and EFL programs. This SLR encourages teachers, teacher educators, and administration to effectively use Mobile-Assisted Language Learning (MALL) as a viable option. It will help the stakeholders to be better equipped in making informed decisions about the use of the Duolingo application in ESL/EFL contexts for second language (English) learners. Future studies may provide a comprehensive overview of the retrieved research on Duolingo for those pursuing ESL/EFL by considering a longer duration. This will help researchers identify research gaps in the area.

**Keywords**: Gamified learning, Duolingo, online learning, ICT in Education, EFL, ESL.

## INTRODUCTION

Multilingual learning programs and courses, especially those offering foreign or globally dominant languages like English, have seen a rise in enrolment. Learners prefer these courses as they are mandatory for trans-boundary migration of students for further education or better job prospects in other countries. Language-based competency exams like TOEFL and IELTS that support migration, especially to some European countries, the US and Australia, are

gaining popularity. Offering multilingual programs has other benefits and challenges, as shown in Table 1.

TABLE 1. Benefits and Challenges of Multilingualism.

| BENEFITS | CHALLENGES |
|---|---|
| Cognitive development and flexibility | Need for trained teachers |
| Improved academic achievement | Resource-intensive implementation |
| Enhanced memory and delayed dementia | Political resistance and policy issues |
| Cross-cultural understanding and empathy | Balancing local and global languages |
| Better career and economic opportunities | Funding and sustainability |
| Preservation of minority languages | Managing social dynamics in classrooms |

*Source: Parentapps Team. (2023, July 17). Retrieved from:* [https://ebinternacional.org/the-benefits-of-a-multilingual-education/](https://ebinternacional.org/the-benefits-of-a-multilingual-education/)

**Digital Game-Based Learning (DGBL) and Mobile-Assisted Language Learning (MALL)**

Many factors shape and influence the process of learning English as a second language (ESL). These include the exceptional skills of both teachers and students, their chosen methods and approaches, and the selection of media or other resources that best suit their needs (Sakkir & Syamsuddin, 2023).

To help students enhance their English LSRW skills, creative strategies must be used by teachers along with engaging materials. Students can enhance their own learning by enrolling in English classes, participating in extracurricular activities, or studying independently in their free time. English courses and supplemental instruction significantly contribute to students' proficiency and skill development. In the rapidly evolving digital era, technology 4.0 offers substantial benefits to both educators and learners. The integration of technology in education is widespread, with continuous efforts to increase access to digital learning through the internet. Mobile-Assisted Language Learning (MALL) has enhanced the possibilities for students to learn a foreign language independently and flexibly at any time by leveraging mobile technology (Reinders & Benson, 2017). With MALL, students can simulate, visualize, and engage with scientific systems and processes, while also supporting secure and prioritized internet access.

According to Kukulska-Hulme (2013), MALL is the incorporation of mobile devices into language learning, especially when mobility is advantageous. The expanded accessibility of

mobile technology enables learners to study a foreign language at their own pace and in any setting.

The digital age has led to a paradigm shift in education. Online learning is becoming an integral part of modern pedagogy. Hence, exploring innovative technologies that are reshaping the learning experience is imperative. Gamified learning is a pedagogical strategy that integrates game design elements into educational contexts. By leveraging game mechanics, such as points, badges, and levels, this approach enhances learner engagement and motivation. By transforming educational content into a game-like experience, gamified learning can foster a sense of achievement, provide immediate feedback, and encourage active participation. A gamified learning approach is effective in a wide range of subjects where students may find traditional methods less engaging.

Digital game-based learning (DGBL) has become a significant approach to language learning with its adaptive artificial intelligence embedded technology. The approach follows constructivist learning principles, which emphasize learners' active role in knowledge construction through hands-on experiences and meaningful interactions (Acquah and Katz, 2020). Leveraging the interactive elements of games, DGBL fosters engaging environments to promote active participation, knowledge building, and the development of essential skills. (Zou et al., 2021). DGBL provides learners opportunities for exploration, experimentation, and problem-solving. These are crucial for language acquisition (Li and Tsai 2013; Reinhardt and Sykes 2012).

Recent studies have shown an increase in the use of digital game-based pedagogies and integration of platforms such as Edpuzzle, Kahoot!, Nearpod, Quizizz and Quizlet in providing gamified learning experiences to develop academic competency in subjects such as social sciences, science, engineering, mathematics, and even language learning. Popular MALL applications like Duolingo allow self-paced practice and engaging exercises for English language learners, helping them progress toward fluency. Duolingo-like applications are specifically designed to allow learners to study anytime, anywhere, encouraging independent learning (Sakkir & Syamsuddin, 2023).

By examining existing literature systematically on the integration of such DGBL and MALL applications, we seek to understand how internet technology, with the help of computers and mobile phones in teaching and learning of English to develop vocabulary, grammar, and LSRW (listening, speaking, reading and writing) skills. Based on the findings of the SLR, this paper aims to identify the effectiveness of the Duolingo language learning application and its impact

on second language (English) learners in terms of their competencies and develop their skills in English.

## RESEARCH QUESTIONS

Although researchers have previously explored the impact of gamified and digital game-based learning on academic achievement, there is a gap in systematic reviews on the findings of Duolingo on learners' competencies in language skills since the Covid-19 pandemic. Furthermore, examining the relationship between the Duolingo language learning app learning and learners' second language skills, specifically in English as a Second Language (ESL) and English as Foreign Language (EFL) settings, can provide valuable insights into the overall perception and effectiveness of this application. Hence, in this study, we have applied a systematic literature review to analyze the open-access journal articles from two reputed databases- SCOPUS and ERIC, to answer the following research questions:

RQ1: What publication trends and demographics of participants as seen in recent studies on the use of Duolingo for developing English language skills in second language (English) learners pursuing ESL and EFL courses? We wish to summarize information regarding year and country of publication, research method, design of study, sample size, and educational level in these studies.

RQ2: What are the key findings reflected from recent studies on the use of the Duolingo language learning application for developing English language skills in second language (English) learners pursuing ESL and EFL courses on the following themes:

    a. Emerging trends in using the Duolingo language learning application over recent years.

    b. Outcomes suggesting effectiveness of Duolingo language learning on particular language skills (e.g., vocabulary, grammar, listening, speaking, reading, and writing).

    c. Effect of Duolingo language learning platform on students' psychological states (motivation, enjoyment, learner autonomy, and engagement).

## METHODOLOGY

### PRISMA Framework and Systematic Search Strategy

This systematic review is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). Two databases, SCOPUS and ERIC, were utilized for the search.

SCOPUS and ERIC databases were accessed using the University of Delhi on-campus access provided to the university students. The SCOPUS and ERIC databases were searched on 25th August 2025 for previous research articles. Both databases are well-reputed in the academic community, specializing in the field of education and contain several papers from reputed

journals in this discipline.

The Boolean operator-based keyword searched articles from the database were subjected to screening, analysis, interpretation and thematically summarizing. In the next phase, articles were subjected to abstract, keywords and title filtration, followed by a full-text analysis and screening. Eventually, the empirical studies related to ESL and EFL using Duolingo were extracted. PRISMA guidelines were followed (Moher et al., 2009).

**Keyword Searched**

Search keywords in SCOPUS (https://www.scopus.com/home.uri) under 'Article title, Abstract and Keywords:'

"Duolingo" AND ("English" OR "ESL" OR "EFL" OR "ELT")

Search Keywords in Educational Resources Information Center (ERIC), (https://eric.ed.gov/?q=) under broad search:

"Duolingo" AND ("English" OR "ESL" OR "EFL" OR "ELT")

Operators used on these databases, along with filters, screened and included only open-access journal articles in English and published since 2021, leaving us with 176 articles.

Operators used on these databases helped in the identification of 176 articles.

**Identification, Eligibility, Screening and Identification**

The inclusion and exclusion criteria for the identification and eligibility phases are given in Table 2.

TABLE 2. Keywords used in SCOPUS and ERIC databases searches.

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| Only journal articles | Any other type of publication |
| Articles in the English language only | Articles in languages other than English |
| Articles published since 2021 | Articles published before 2021 |
| Open access articles | Sources with no open-access version of articles |

According to the inclusion criteria, only published open-access journal articles are selected from SCOPUS and ERIC databases after the keyword search. Books, chapters in books, conference proceedings, and other texts are excluded. This particular criterion is restricted to articles written in English and published since 2021. Only empirical research-based journal articles that are from the Social Sciences, Arts and Humanities, and Psychology fields of study were considered eligible. Non-empirical research, systematic reviews and thematic reviews were excluded. Based on the inclusion criteria, we were left with 47 studies for the title, keyword and abstract screening phase.

After applying the inclusion and exclusion criteria, 47 journal articles were selected, and using Zoterro, 5 duplicate and/or retracted articles were removed. This left us with 42 articles.

In the next phase of retrieving articles, the researcher went through the keywords, date of publication, abstract and titles, to enable the extraction of all relevant data during the data collection process, leaving us with 35 open-source articles.

The articles were further screened on the following criteria: (i) having a sample of second language (English) learners, (ii) having a sample of non-disabled students and those without neurodivergent disorders (iii) articles only related to developing language skills in ESL and EFL courses and programs using the Duolingo language learning application. Consequently, 16 more articles from the two bases were found irrelevant for this study and eliminated, leaving a total of 19 articles.
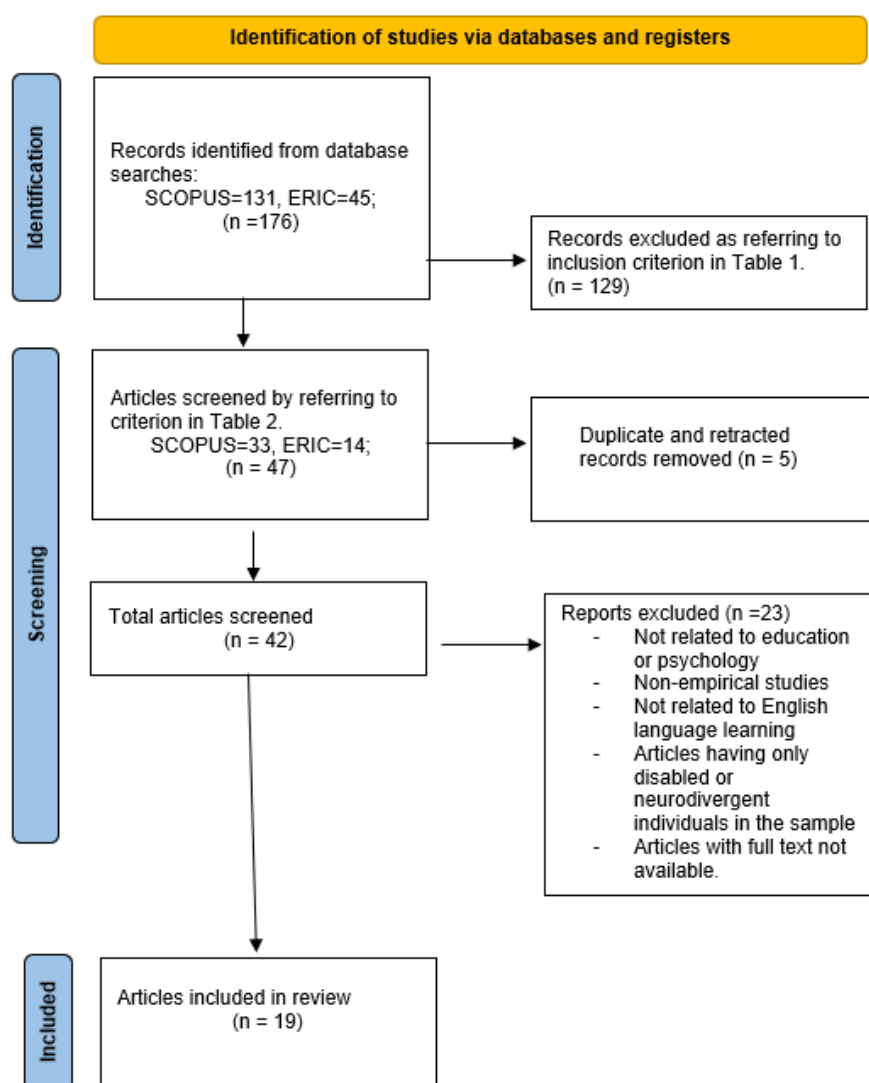


FIGURE 1. PRISMA 2020 flow diagram, adapted from Page et al. (2021), for systematic reviews.

**RESULTS**

A total of 19 articles were extracted at the end of the selection process. The title of these articles, their author(s), publication year and country are summarized in Table 3.

TABLE 3. Nineteen selected articles, their author(s), publication year and country.

| S. No. | Author(s) | Year | Country | Title |
|---|---|---|---|---|
| 1 | Abdellatif, M.S.; Alshehri, M.A.; Alshehri, H.A.; Hafez, W.E.; Gafar, M.G.; Lamouchi, A. | 2024 | Saudi Arabia | I am all ears: listening exams with AI and its traces on foreign language learners' mindsets, self-competence, resilience, and listening improvement |
| 2 | Ahmed, A.; Hassan, I.; Pallathadka, H.; Keezhatta, M.S.; Haryadi, R.N.; Al-Mashhadani, Z.I.; Attwan, L.Y.; Rohi, A. | 2022 | Iran | MALL and EFL Learners' Speaking: Impacts of Duolingo and WhatsApp Applications on Speaking Accuracy and Fluency |
| 3 | Alfuhaid, Sultan R. | 2021 | Saudi Arabia | The Utilisation of Duolingo to Enhance the Speaking Proficiency of EFL Secondary School Students in Saudi Arabia |
| 4 | Davudova, Enejan; Türel, Yalin Kiliç | 2022 | Turkey | Evaluation of Mobile Applications in Foreign Language Learning at Early Age |
| 5 | Ergün-Elverici, S. | 2023 | Turkey | Integrating Mobile Technologies: Two Stage Study on Academic Performance and Social Presence |
| 6 | Kaosayapandhu, Munchuree | 2023 | Thailand | Application for Grammar Skills: A Case Study of Thai EFL Undergraduates |
| 7 | Kazu, Ibrahim Yasar; Kuvvetli, Murat | 2024 | Turkey | Improve Speaking Skills with Duolingo's Mobile Game-Based Language Learning |
| 8 | Kic-Drgas, J.; Kılıçkaya, F. | 2024 | Poland and Turkey | Exploring novel approaches to digital self-regulated learning: a study on the use of mobile applications among Polish and Turkish EFL pre-service teachers |

| | | | | |
|---|---|---|---|---|
| 9 | Lehan, V.; Hodovanets, N.; Muraviova, I.; Litvinova, M.; Baibakova, O. | 2023 | Ukraine | Formation of lexical competence in foreign philology (English) students during online education |
| 10 | Ma, Y.; Chen, M. | 2024 | China | AI-empowered applications effects on EFL learners' engagement in the classroom and academic procrastination |
| 11 | Olimat, K.N. | 2024 | Jordan | The Reality and Effects of Using Duolingo to Develop English Language Skills for EFL Learners in Jordan |
| 12 | Ouyang, Z.; Jiang, Y.; Liu, H. | 2024 | China | The Effects of Duolingo, an AI-Integrated Technology, on EFL Learners' Willingness to Communicate and Engagement in Online Classes |
| 13 | Pikhart, M.; Klimova, B.; Al-Obaydi, L.H. | 2024 | Czech Republic, Taiwan, and Iraq. | Exploring university students' preferences and satisfaction in utilizing digital tools for foreign language learning |
| 14 | Purwanto, Anton Adi; Syafryadin | 2023 | Indonesia | Students' Perception on Using Duolingo for Learning English Vocabulary |
| 15 | Qiao, H.; Zhao, A. | 2023 | China | Artificial intelligence-based language learning: illuminating the impact on speaking skills and self-regulation in Chinese EFL context |
| 16 | Teba, Sourou Corneille | 2022 | Benin Republic | Using Duolingo to Improve Beninese Secretarial Advanced Learners' Oral Communication Skills |
| 17 | Ünal, Erhan; Güngör, Fatih | 2021 | Turkey | The Continuance Intention of Users toward Mobile Assisted Language |

| | | | | |
|---|---|---|---|---|
| | | | | Learning: The Case of Duolingo |
| 18 | Zeng, C.; Fisher, L. | 2024 | China | Opening the "Black Box": How Out-of-Class Use of Duolingo Impacts Chinese Junior High School Students' Intrinsic Motivation for English |
| 19 | Zhou, S. | 2024 | China | Gamifying language education: the impact of digital game-based learning on Chinese EFL learners |

**Demographic Information of Studies**

The demographic information of the 19 articles based on the country study was conducted, education level of participants, year of publication, and type of approach are covered in this section. The articles were further analyzed, interpreted and later thematically summarized.

**Country-Wise Distribution of Studies**

The 19 articles extracted were from sixteen countries and are listed in Table 2. They are displayed in the form of a bar graph in Figure 2. Of these, five studies were carried out in Turkey and China, two studies were carried out in Saudi Arabia, and one in Benin Republic, the Czech Republic, Indonesia, Iran, Iraq, Jordan, Poland, Taiwan, Thailand and Ukraine each.
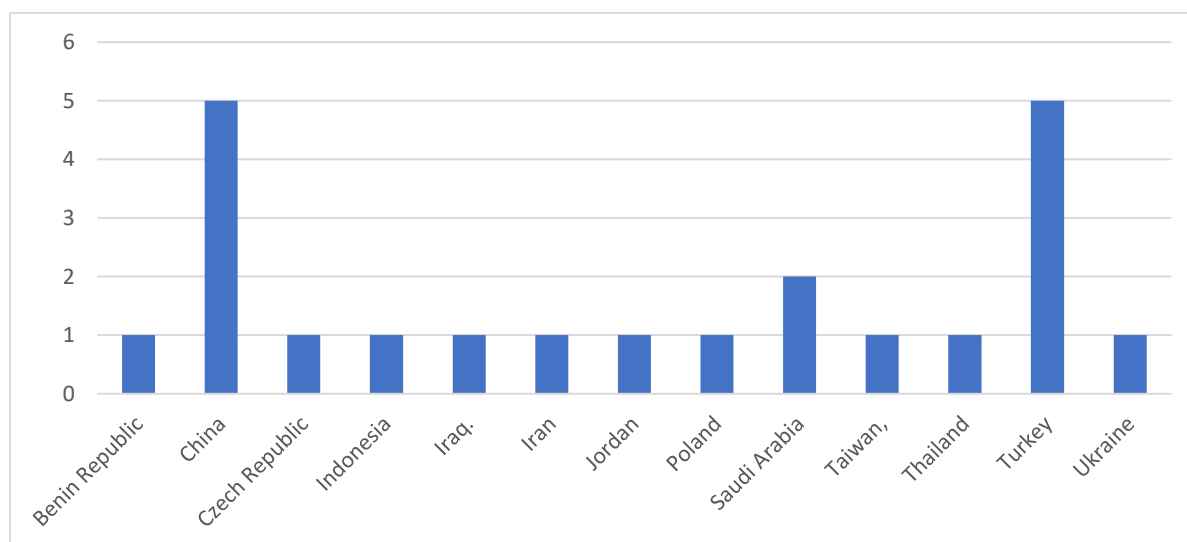


FIGURE 2. Number of articles published based on the country of study

**Year-Wise Distribution of Studies**

The list of selected articles based on year of publication is shown in Table 3 and shown on a bar graph in Figure 3. In summary, a majority of studies (nine) were published in 2024. Five articles

were published in 2023, three in 2022, and two in 2021. No studies have been published on the two databases in 2025 (until August). The reason lesser number of studies in the early years is attributed to the onset of the COVID-19 pandemic. Ever since, the use of technology and distance learning has shown an increasing trend, and it can be reflected in the articles getting published over the years.
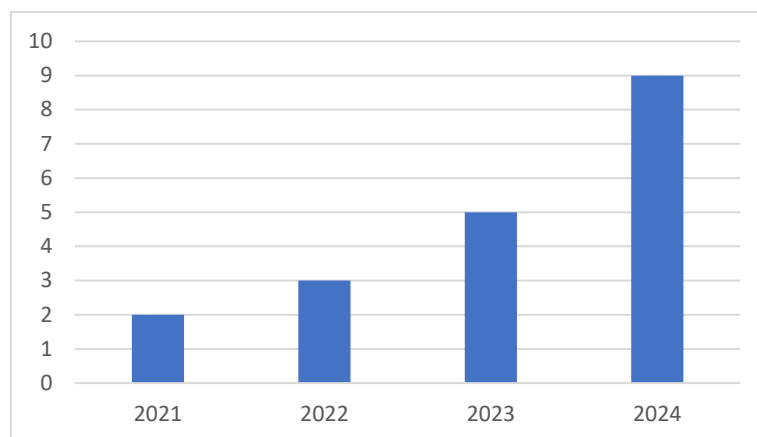


FIGURE 3. Number of articles based on their publication year

**Research Method Used**

The details of the school level of the sample selected, sample size and method used in the identified 19 articles for this systematic review are given in Table 4.

TABLE 4. Author, school level, sample size and method used in 19 articles selected under this study.

| Sr. No. | Author (s) | Educational Level | Sample Size | Method (Qualitative or Quantitative or Both) |
|---|---|---|---|---|
| 1 | Abdellatif et al. (2024) | Higher Education | 57 | Quantitative |
| 2 | Ahmed et al. (2022) | Middle Level | 90 | Quantitative |
| 3 | Alfuhaid (2021) | Senior Secondary | 28 | Quantitative |
| 4 | Davudova et al. (2022) | Primary Level | 87 | Both |
| 5 | Ergün-Elverici (2023) | Senior Secondary | 32 | Both |
| 6 | Kaosayapandhu (2023) | Senior Secondary | 128 | Quantitative |
| 7 | Kazu et al. (2024) | Senior Secondary | 76 | Both |

| | | | | |
|---|---|---|---|---|
| 8 | Kic-Drgas et al. (2024) | Higher Education | 206 | Quantitative |
| 9 | Lehan et al. (2023) | Higher Education | 2,500 | Quantitative |
| 10 | Ma and Chen (2024) | Higher Education | 350 | Quantitative |
| 11 | Olimat (2024) | Higher Education | 500 | Quantitative |
| 12 | Ouyang et al. (2024) | Higher Education | 80 | Quantitative |
| 13 | Pikhart et al. (2024) | Higher Education | 148 | Qualitative |
| 14 | Purwanto et al. (2023) | Middle Level | 25 | Quantitative |
| 15 | Qiao et al. (2023) | Higher Education | 93 | Quantitative |
| 16 | Teba (2022) | Other | 50 | Both |
| 17 | Ünal et al. (2021) | Higher Education | 379 | Quantitative |
| 18 | Zeng et al. (2024) | Middle Level | 20 | Qualitative |
| 19 | Zhou (2024) | Higher Education | 70 | Both |

**Distribution of studies across different school levels**

In most of the studies, focused on the higher educational institutional level. One (5%) study focused on the primary school level. Three (15%) studies covered the middle school level. One (5%) study covered secondary school and three studies (15%) covered senior secondary school levels each. Most of the studies, i.e., ten (or 50%) covered a higher educational level. One study mentioned samples were drawn from vocational and technical institutes beyond the purview of school and higher-level institutions. Figure 4 shows the demographic distribution of participants studied across different school levels in the form of a pie chart.
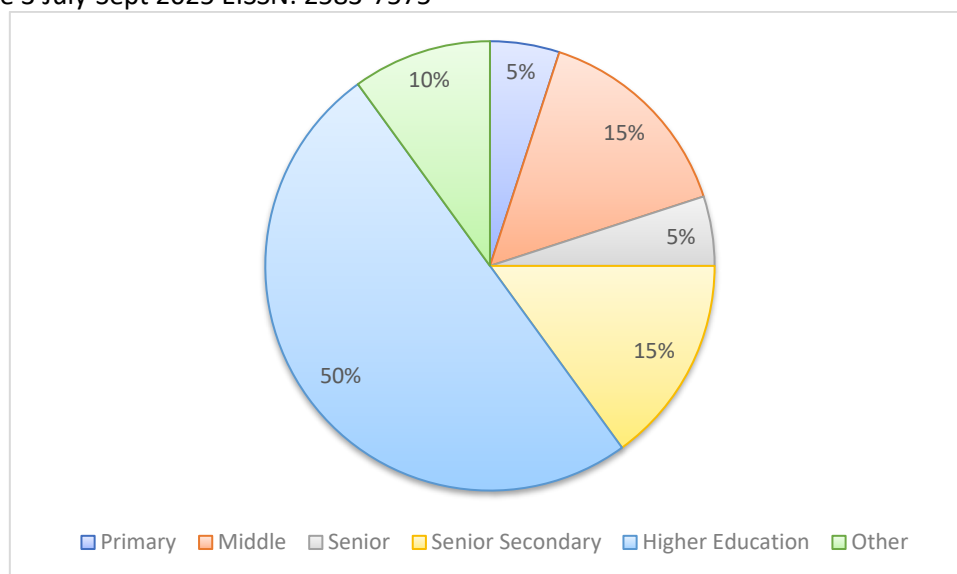
FIGURE 4. Demographic Distribution of Participants Based on their Educational Level across Studies

**Distribution of Studies Based on Research Method**

In the selected studies, all three research approaches were used: qualitative, quantitative and a combination of both/mixed method. As shown in Figure 5 in the form of a pie chart, there were 13 (or 68%) quantitative studies, whereas 2 (or 11%) studies used a quantitative approach. Also, 4 (or 21%) of the studies used a mixed-methods approach.
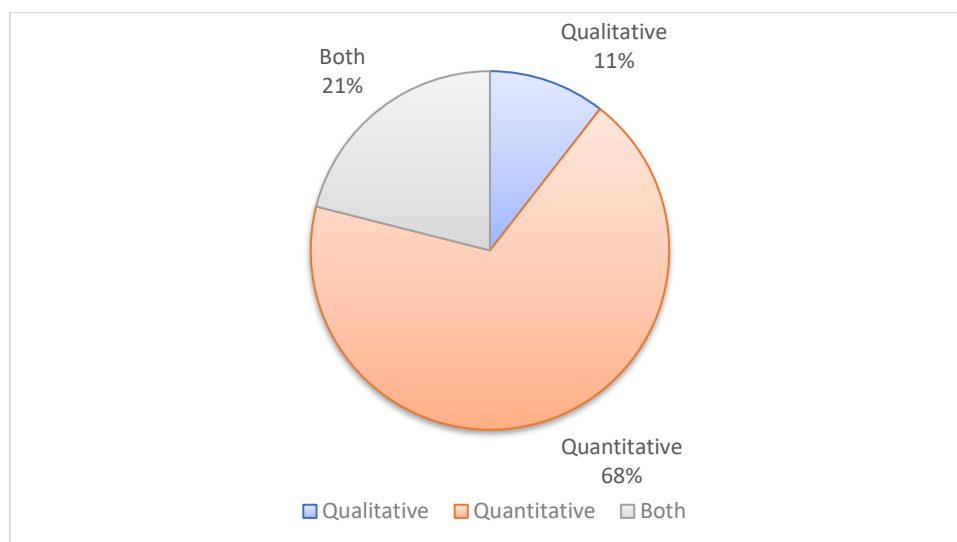


FIGURE 5. Distribution of Research Methods Employed Across the Studies

**Applications and/or Software Used along with Duolingo and Research Design**

Table 5 depicts the applications and/or software used along with Duolingo and the design of research employed in each study. Most of the studies showed experimental research designs.

TABLE 5. Summary of software(s)/application(s) or game(s) used and the research designs incorporated in the studies.

| Sr. No. | Author(s) | Game(s) or software(s) or online application(s) used | Research Design |
|---|---|---|---|
| 1 | Abdellatif et al. (2024) | Duolingo and Nearpod | Quasi-experimental |
| 2 | Ahmed et al. (2022) | Duolingo and WhatsApp | Quasi-experimental |
| 3 | Alfuhaid (2021) | Duolingo | Experimental design |
| 4 | Davudova et al. (2022) | Duolingo and Memrise | Experimental design and thematic analysis |
| 5 | Ergün-Elverici (2023) | Duolingo | Experimental design and descriptive content analysis |
| 6 | Kaosayapandhu (2023) | Duolingo | Quasi-experimental design |
| 7 | Kazu et al. (2024) | Duolingo | Quasi-experimental design and thematic analysis |
| 8 | Kic-Drgas et al. (2024) | Duolingo, Quizlet, Cambly, Babbel, Busuu, and others. | Survey design. |
| 9 | Lehan et al. (2023) | Kahoot!, Moodle, Duolingo, Google Forms, Lingohut, Quizlet and others | Systematic and logical analysis. |
| 10 | Ma and Chen (2024) | ChatGPT, POE, and Duolingo and other AI-based applications | Quasi-experimental |
| 11 | Olimat (2024) | Duolingo | Descriptive (quantitative) analysis |
| 12 | Ouyang et al. (2024) | Duolingo | Quasi-experimental |
| 13 | Pikhart et al. (2024) | Duolingo, ChatGPT, and Google Translate; digital games | Thematic analysis |
| 14 | Purwanto et al. (2023) | Duolingo | Descriptive (quantitative) analysis |
| 15 | Qiao et al. (2023) | Duolingo | Randomized controlled trial (RCT) |
| 16 | Teba (2022) | Duolingo | Quazi-experimental |

| 17 | Ünal et al. (2021) | Duolingo | Cross-sectional survey |
|---|---|---|---|
| 18 | Zeng et al. (2024) | Duolingo | Case Study with inductive and deductive analysis |
| 19 | Zhou (2024) | Duolingo | Experimental design and thematic analysis |

**Parameters/Domains of the Study**

In Table 6, a list of parameters that were analyzed to test different skills for a second language (English) in different studies is presented

TABLE 6. Summary of parameters/domains observed under the studies.

| Sr. No. | Author(s) | Parameters/Domains of Study |
|---|---|---|
| 1 | Abdellatif et al. (2024) | Language learners' mindsets, self-competence, resilience, and listening skills. |
| 2 | Ahmed et al. (2022) | Speaking accuracy and fluency |
| 3 | Alfuhaid (2021) | Speaking proficiency: pronunciation, grammar, vocabulary, comprehension, and fluency. |
| 4 | Davudova et al. (2022) | English achievement: listening, speaking, reading, and writing skills. |
| 5 | Ergün-Elverici (2023) | Academic performance in listening, speaking, reading, and writing skills, and social presence. |
| 6 | Kaosayapandhu (2023) | Verb tense knowledge; frequency of Duolingo use, completion of levels, perceived achievement in Duolingo, and enjoyment. |
| 7 | Kazu et al. (2024) | Speaking proficiency; emotional and cognitive dimensions such as learner engagement, and motivation. |
| 8 | Kic-Drgas et al. (2024) | Self-regulated learning, motivation, attitude, enjoyment and others |
| 9 | Lehan et al. (2023) | Lexical competence |
| 10 | Ma and Chen (2024) | Affective, cognitive, and behavioural engagement; academic procrastination. |
| 11 | Olimat (2024) | English language skills (listening, reading, writing, and speaking). |

| 12 | Ouyang et al. (2024) | Willingness to communicate (WTC) and engagement in English as a foreign language (EFL). |
|---|---|---|
| 13 | Pikhart et al. (2024) | Vocabulary acquisition, skill development (listening, speaking, writing, reading), and overall satisfaction with the digital resources. |
| 14 | Purwanto et al. (2023) | Students' perceptions towards Duolingo, vocabulary, students' enthusiasm for Duolingo app in vocabulary, students' ambition on vocabulary learning, the strengths of Duolingo, and the negatives of Duolingo. |
| 15 | Qiao et al. (2023) | Speaking skills (fluency, vocabulary, accuracy, and pronunciation) and self-regulation. |
| 17 | Teba (2022) | Oral Communication Skills: Fluency, Pronunciation, Grammar and Vocabulary |
| 18 | Ünal et al. (2021) | Students' continuance intention to use mobile-assisted language learning (MALL), perceived usefulness, perceived ease of use, attitude, subjective norms, student readiness, instructor readiness, perceived behavioral control, self-efficacy, learning autonomy, satisfaction, and confirmation. |
| 19 | Zeng et al. (2024) | Intrinsic Motivation |
| 20 | Zhou (2024) | Enjoyment, ideal self-perception, and intrinsic motivation. |

**Summary of Findings from the Studies**

Abdellatif et al. (2024) found that EFL learners who participated in AI-based listening exams demonstrated significant improvements in their mindsets, self-competence, resilience, and listening skills. The AI-driven exams integrated through Duolingo and Nearpod provided an engaging and adaptive learning experience. It provided personalized feedback and adaptive questions to target individual weaknesses. Overall, the learners showcased more positive learning mindsets, enhanced self-perceived competence, and measurable improvement in listening comprehension.

Ahmed et al. (2022) studied both the Duolingo and WhatsApp applications' effectiveness in improving the speaking fluency and accuracy of EFL learners, although no significant difference between the two applications was found in their effectiveness. Groups receiving instructions through the two applications outperformed those who received traditional classroom instruction. This suggests that using online applications is more engaging to EFL learners and can improve their

motivation and reduce learning anxiety.

Alfuhaid's (2021) study found that integrating Duolingo into the learning process significantly improved the speaking proficiency of EFL students. After four months, the learners using Duolingo significantly performed better than the control group in speaking skills. This improvement was attributed to increased confidence and reduced anxiety through practice. It also demonstrated enhancement in vocabulary range and grammatical accuracy. The researcher concluded that technology integration is a valuable tool for enhancing EFL students' language skills.

Davudova et al. (2022) compared the effectiveness of mobile applications, Duolingo and Memrise. Both led to a significant positive effect on students' overall English achievement, especially in reading and writing skills. Duolingo was effective in enhancing the listening, speaking, reading and writing skills of learners, while Memrise was even more effective in developing listening, reading, and writing skills as compared to Duolingo. Students and parents generally viewed these applications as fun and effective for learning English. The study suggests that incorporating mobile applications into foreign language learning can improve academic success and student engagement.

Ergün-Elverici's (2023) research revealed that integrating Duolingo into English classes had a positive impact on students' academic performance, particularly in writing, listening, and speaking. It also indicated a significant increase in social presence among students in the experimental group. Analysis of qualitative data from follow-up interviews revealed that students found Duolingo entertaining and accessible while also benefiting from parental consent and teacher guidance. The findings suggest that mobile technologies like Duolingo can be valuable tools for enhancing language learning and also helpful in socialization.

Kaosayapandhu (2023) studied verb tense knowledge in Duolingo users who demonstrated a significant improvement. The frequency of Duolingo use, perceived achievement, and perceived enjoyment positively influenced performance among the user group. The implication is that Duolingo is a potentially useful supplement to classroom learning, although its effects may change over time as users become habituated.

Kazu et al. (2024) also found that using Duolingo significantly improved the speaking proficiency of language learners compared to traditional classroom-based instruction. The gamification and interactive exercises within Duolingo played a crucial role in enhancing oral fluency. The research highlights the importance of integrating technology and gamified approaches into language education to foster learner engagement, motivation, and ultimately, improved speaking skills.

Kic-Drgas et al. (2024) found that Duolingo was the most widely used application among Polish and Turkish EFL pre-service teachers for self-regulated language learning. The study also revealed a shift

in learning patterns following the pandemic, with an increase in the use of online applications. Although some cultural and gender differences were observed in the use of these applications, the findings suggest that online applications offer promising opportunities to enhance and support self-regulated learning experiences in English language acquisition.

Lehan et al. (2023)- in their study found that teachers use various ICT tools like Kahoot!, Moodle, Duolingo, Google Forms, Lingohut, and Quizlet to enhance lexical competence in distance learning. The study showed that specific exercises like translation of international words, communicative exercises, and word comparison led to the majority of students (95.5%) perceiving a positive impact of ICTs on their lexical competence development.

Ma and Chen (2024) study found that AI-empowered applications significantly enhanced learner engagement (affective, cognitive, and behavioral) and reduced academic procrastination among EFL learners. This study too advocates for their integration in diverse educational settings, emphasizing learner-centered approaches.

Olimat (2024), through descriptive analysis of responses to questionnaires from Jordanian EFL learners revealed that they were aware of the effectiveness of Duolingo in developing their English language skills (listening, reading, writing, and speaking abilities). The users also agreed that Duolingo was able to make them more confident in using English, manage stress and even develop their non-verbal communication skills.

In their study, Ouyang et al. (2024) found that using Duolingo significantly improved EFL learners' willingness to communicate and engagement in online classes. showing significant gains in affective, cognitive, and behavioral engagement in participants. Furthermore, the experimental group demonstrated improvement in both communication skills and overall engagement with a statistically significant increase in their willingness to speak, read, write, comprehend, and communicate in English.

EFL college students from the Czech Republic, Taiwan, and Iraq were found to utilize digital resources like Duolingo, ChatGPT, and Google Translate in diverse ways for language learning in a study conducted by Pikhart et al. (2024). These tools are used for vocabulary acquisition, skill development, and language exploration. While students generally expressed satisfaction with these resources, challenges such as connectivity issues and content variety were identified. The study highlights the positive impact of digital tools on language learning experiences, emphasizing the need for ongoing improvement and personalized learning paths.

Purwanto et al. (2023) found that a majority of students were encouraged to learn English vocabulary through the Duolingo application. Students found the app easy to navigate through, making them

more interested and excited about learning new words. Duolingo also helped prevent boredom and encouraged new learning methods. Overall, the students' perception of using Duolingo was positive and helpful for enhancing vocabulary during English learning.

Qiao et al. (2023) studied the AI-based instruction while using the Duolingo application. Their study revealed significant improvement in second language speaking skills (fluency, vocabulary, accuracy, and pronunciation) and self-regulation among Chinese EFL students compared to traditional instruction. Speaking anxiety had a noticeable negative effect on fluency and pronunciation. The findings suggest that AI technology has the potential to optimize language learning experiences and promote learners' autonomy and metacognitive strategies in the speaking domain.

Duolingo as a supplement to traditional ESP courses, significantly improved the oral proficiency of Beninese secretarial students in technical and vocational programs in a study carried out by Teba (2022). The intervention given allowed learners to use Duolingo for 15 minutes daily for three months, leading to a statistically significant improvement in their learning. The adaptive features of AI, as per learner needs, resulted in self-regulated autonomous learning in most of the participants. The study also demonstrated that most of the teachers were not comfortable with the use of technology in the classroom. The study encourages teachers to invest in their professional development to effectively integrate such technologies to overcome the deficiencies in the traditional classroom.

Ünal et al. (2021) found that perceived behavioral control, attitude, subjective norms, satisfaction, and perceived usefulness significantly affected university students' continuance intention to use MALL after 24 weeks of experience with Duolingo. Perceived behavioral control was the most influential factor. Self-efficacy and learning autonomy influenced perceived behavioral control.

Zeng et al. (2024) observed use of Duolingo outside of class among Chinese junior high school. The study found positive impacts on students' intrinsic motivation (IM) for learning English. The researchers propose a 'motivational transfer' mechanism, where activity-specific IM for using Duolingo, driven by the psychological needs for autonomy and competence, gets transferred and associated with learning English. The study supports the idea that mobile-assisted language learning (MALL) apps like Duolingo can be an effective tool to stimulate language learning motivation beyond the classroom, suggesting that this acquired motivation while using the app can be transferred to classroom learning.

Zhou (2024) found that digital game-based learning (DGBL) significantly increased enjoyment and the ideal self-perception towards English learning among learners. Participants in the DGBL group, who used Duolingo, showed greater gains in these areas compared to the control group, which

received traditional EFL instruction. The ideal self of students was found to predict higher enjoyment during gameplay. Qualitative results also highlighted increased engagement, perceived learning improvements, and a sense of autonomy fostered by DGBL, as it gave a sense of enjoyment and helped develop a positive self-concept of EFL learners.

## FINDINGS AND DISCUSSIONS

Of the 19 articles extracted from sixteen countries maximum were from Turkey and China with five each. Most of the studies, i.e., ten (or 50%), on ESL and EFL were carried out at higher educational levels. The trend in these studies has largely followed a quantitative approach. There were 13 (or 68%) quantitative studies screened out since 2021, most of which have followed an experimental design.

AI-driven DGBL tools are a prominent theme emerging across the research for enhancing the EFL experience towards self-learning. AI-powered listening exams enhanced learners' self-perceived competence, resilience, and listening comprehension through adaptive question design and personalized feedback (Abdellatif et al., 2024). AI-enhanced applications increased learner engagement across affective, cognitive, and behavioral dimensions while significantly reducing procrastination (Ma and Chen, 2024). Furthermore, AI can play a significant role in improving speaking skills—fluency, vocabulary, and pronunciation—while also enhancing self-regulation and autonomy (Qiao et al., 2023). These studies underline that AI applications foster holistic growth, help in skill acquisition with motivational and psychological development and also make good tools for individualized assessment.

Duolingo, as a MALL platform, can particularly work well in developing oral communication. Alfuhaid (2021) found that learners using Duolingo showed notable improvement in speaking proficiency, vocabulary range, and grammatical accuracy, with learners experiencing greater confidence and reduced anxiety. Similarly Duolingo's gamified exercises enhanced speaking proficiency and oral fluency more effectively than traditional instruction. (Ouyang et al., 2024; Kazu et al., 2024). Study conducted by Teba (2022) demonstrated significant oral proficiency gains for ESP learners using the app as a supplement to courses. Ahmed et al. (2022) also showed that Duolingo and WhatsApp reduced anxiety and enhanced speaking skills compared with traditional classrooms.

Gamification and mobile platforms positively impact of motivation, learner autonomy, and engagement. Zeng et al. (2024) demonstrated the idea of "motivational transfer," showing how intrinsic motivation to use Duolingo is carried over to general motivation for learning English. Zhou (2024) found that digital game-based learning using Duolingo significantly increased

enjoyment, engagement, and ideal send language learners' self-concepts. Similarly, Duolingo was associated with perceived usefulness, satisfaction, sustained interest and behavioral control (Purwanto et al. 2023; Ünal et al. 2021). Collectively, these studies highlight that motivation, enjoyment, and autonomy are key outcomes of gamified and mobile learning environments.

MALL can also improve areas of academic and linguistic competence. Davudova et al. (2022) demonstrated that Memrise supported gains particularly in reading and writing, often outperforming Duolingo in these areas. Ergün-Elverici (2023 )too reported that Duolingo integration significantly improved writing, listening, and speaking, while also strengthening learners' social presence in class. Kaosayapandhu (2023) reported notable improvement in verb tense knowledge among frequent Duolingo users. Lehan et al. (2023) also highlighted in their study that ICT platforms like Duolingo, Moodle, Kahoot!, and Quizlet positively contributed to lexical competence development in distance learning settings. Olimat (2024) found that English learners perceived Duolingo to be effective across all four language skills- listening, speaking, reading, and writing.

Cross-cultural perspectives revealed diverse contextual patterns in MALL adoption. Kic-Drgas et al. (2024) observed this among pre-service teachers, where cultural and gender differences shaped learning habits using Duolingo. Pikhart et al. (2024) also observed cross-national differences in the use of the app between users of the Czech Republic, Taiwan, and Iraq, reflecting opportunities while also highlighting barriers such as infrastructure. These findings suggest cultural differences and contextual challenges can influence application use. Hence, the teachers play a key role in effectively helping learners adopt MALL apps in their study habits as per the cultural feasibility. At large, learners benefited from Duolingo due to the flexibility, engagement, and motivational benefits it offered.

In summary, the studies show that mobile-assisted and AI-based language learning applications (especially Duolingo) substantially improve language skills by encouraging learners' autonomy. They are particularly effective for speaking skills, expanding vocabulary, and engagement. They may be less effective than human instruction for pronunciation and reading. Contextual factors (culture, pandemic shifts) also needed to be considered since they correlated with the extent of adoption and success of outcomes. Challenges like connectivity and limited content variety are also widely reported.

**CONCLUSION AND SUGGESTION FOR FUTURE WORK**

In this study on systematic review, using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, a total of 19 studies published since 2021

were synthesised on the AI and mobile-assisted language learning (MALL) tool 'Duolingo,' an application for developing language competencies. These studies were thematically represented into categories that highlight their core contributions and areas of second language, English, learners. The findings from this systematic review largely suggest that the use of digital games is a valuable tool for developing English language skills in students pursuing ESL and EFL courses by second language (English) learners.

Teachers must allow the use of MALL in the classroom and encourage the autonomy of learners. Schools and teachers should invest in resource allocation and professional development to effectively integrate such technologies to overcome the deficiencies in traditional classroom teaching such as repeated boring tasks and inadequate testing and evaluation systems.

MALL works best as a complement rather than a substitute for classroom learning. Hence, teachers must utilize the application to maximize its benefits in developing English proficiency among diverse learners.

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# Horizontal Proportions of the Face Biometric among Brahmins and Vaishyas Male and Female in Lucknow District

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**Abstract**

Biometrics refers to a particular class of identification technologies which use an individual's unique biological traits to determine one's identity. Faces have long been used as a means of human identification in the forensic field. Its reliability increases when we concentrate on specific population due to uniqueness of its gene pool. This article is based on the comparative analysis of face biometrics of Brahmin and Vaishya communities of Lucknow District. Objectives: The objectives of the present study will be as follows-To apply the fundamental principles of face biometric for personal identification of Brahmins and Vaishyas population inhabiting in Lucknow district. To access the face recognition among both endogamous the population inhabiting in Lucknow district. To identify the varying frequencies of biometrics trait in different caste to be considered and gender differences in relation to quantitative biometrics traits. To find out the intrapopulation and interpopulation variation among Brahmins and Vaishyas community-based face biometric. Methods: The data for the study was obtained from 400 males and females subjects (200 Brahmins males and 200 Vaishyas). Five measurements were taken using five selected landmarks and 7 indices were calculated from the frontal face images of each individual. Results: A t-test revealed, significant ethnic differences ($p<0.05$) between Brahmin and Vaishya males and females The purpose was to examine the existence of Horizontal proportions of the Face Biometrics among Brahmins and Vaishyas male and female Lucknow population. The result indicates that this method is useful in recognizing faces. Conclusion: face of a person holds utmost importance and it should be studied first of all because the human face is the reflection of individual uniqueness of a person.

Keywords: Face Recognition, Biometrics, Brahmins, Vaishyas, Males, Females

**Introduction**

The term Biometrics has its origin from the Greek words bios (life) and metric (measure). This means life and measurement respectively. Biometrics is the most powerful technology sector that

refs to an individual class of identification technology. These technologies used in individual's unique biological traits to establish one's identity. Biometrics is person's identification based on his/her physiological or behavioural characteristics. Most of the system needs personal reliable recognition system to prove or determine the identity of an individual who requires particular service. (Sumathi and Malini et al., 2011).

**Face Biometrics:** The main aim of biometry is to make systems that can identify people from some recognizable characteristics such as their face, fingerprints, iris, etc. Identification of humans by the unique characteristics of their face is called facial recognition. With the globalization of the world, the requirement of identification of individual has increased and has become a necessity of the current age. In recent society the person identification systems are progressively becoming prevalent. Modern face recognition has achieved an identification rate of higher than 90% for larger databases with well-controlled lighting and pose situations. (Fromherz and Bichsel et al. 1997). The face recognition is enhanced biometrics compared to other biometric characteristics as the image can be captured without the knowledge and support of a person. (Hiremani and Hatture, 2013).

A new approach introduced in year 2012 in which the facial features from training images are extracted, then ratios of length, width, and area are calculated and stored as features for individual images, these uniqueness of face eventually helps us to identify a person and differentiate from another face. Face has its individual form, dimensions and features which can be evaluated morphologically as well as metrically. (Roelofse and Becker et al. 2008).

Biometric facial recognition system will quickly overtake fingerprint biometrics as the most famous appearance authentication. While the advent of photography, both government agencies and private organizations have reserved face photo sets of people (e.g. passports, personal identification documents, membership cards, etc.).

**Face Recognition Methods:** In the beginning of the 1970's, face recognition was treated as 2D pattern recognition. (Goldstein, et al., 1971). The distances between main points where used to recognize known faces, e.g. measuring the space between the eyes or other important points or measuring various angles of facial components. A number of algorithms have been proposed for face recognition. Such algorithms can be divided into two categories:

☐ Appearance Based

☐ Feature Based

**1. Appearance-based Method:** This method uses the whole face area as the input to the face recognition system. These systems usually operate on 2D images, using the raw image data to make comparisons of other face images. Its method has received significant attention from a wide range of research areas such as biometrics, pattern recognition. Specifically, there are two categorizations implied viz. Holistic and Hybrid approaches. (Nefian and. Hayes et al.,1998).

**2. Feature Based Method:** The facial features of human being have played a significant task in the recognition of persons for long time. After performing anthropometric measurement on several frontal face images taken from various human's subjects, an anthropometric model of the human face is build that can be used to locate the most important facial feature areas from face images. (Sohail and Bhattacharya et al.,2006). Features in facial images include eyes, nose, mouth, lips and chin etc., of human have played a significant role in the recognition of individuals, which are selected from face images, and then compute the geometric relationships properties among those facial points, thus tumbling the input facial image to a vector of geometric features and relations such as areas, distances between the features are selected as the descriptors of faces for recognition. (Ivancevic et al., 2003). Standard statistical pattern recognition techniques are then employed to match faces using these measurements. The main advantage obtained by the featured-based techniques is that since the extraction of the feature points precedes the analysis done for matching the image to that of an identified individual, such techniques are relatively strong to location variations in the input image. It is appreciably different from the feature-based systems that it constructs the topological graph using the facial features of every subject. (Beham and Roomi et al., 2013).

**Photo-anthropometry:** Various studies have showed that the personal identification process can also be done by using anatomical landmarks and measurements or proportions obtained using landmarks from the photograph evidence. This technique traces its roots to traditional anthropometric methods. In face anthropometry, the quantification measurements are taken from photographs; it is called photo-anthropometry. This form of identification can be termed as 'Facial Image Identification' or 'Photoanthropometry'. Photogrammetry is based on the spatial measurements of facial features as well as distance between facial landmarks. (Alspaugh et al.,2004). Photo-anthropometry is now an acceptable tool in the identification with a manual technique. In the present research to overall the manual method for identification.

**Materials and Methods**

Present study the procedure of purposive sampling was adopted. In this research deals with the measurement on face of 400 subjects including 200 Brahmins and 200 Vaishyas (100 male and 100 female) belonging two endogamous caste groups, i.e. Brahmins and Vaishyas of Lucknow region the age groups of 18-45 years.

From the general information of all the subjects obtained before taking the photographs with name, age, sex, community, caste, sub caste, domicile and address, were recorded (by cross-checking information mentioned by them as per their Identity card or Aaddhar card). Data for the present study were selected from the various places viz. colleges and University for the younger age groups in different areas of Lucknow Region. For the representative population following areas were covered, which are listed below:

Alambagh, Alamnagar, Aishbagh, Aliganj, Aminadad, Ashiyana, Bawali, Charbagh, Chowk, Daliganj, Ganeshganj, Gomtinagar, Indranagar, Janakipuram, Rajajipuram, Saadatganj, Thakurganj, Telibagh. The following equipment are essential while dealing with face biometrics:

**Camera:**

A camera is an optical instrument used to capture images, which are stored in a physical medium such as in a digital system or on photographs. It is a very essential tool for this study. Sony Lens G cyber shot 20x optical zoom digital camera was used in order to get a very clear facial image.

**Tripod:**

It is an essential equipment to provide stability while taking the photographs. Frontal face of 200 individuals was photographed using "Sony Lens G cyber shot" under the similar lighting conditions, with no illumination changes. Setting of the camera was same throughout the collection of photographs. The camera was setup on a tripod at same height of (105cm). The photographs of frontal face of all the subjects were taken from the angles perpendicular to the head with a fixed distance of 2 feet between face and the camera. Structure of Face Biometric system has four main features that are: Photography, Image Preprocessing, Normalization and Face Photometric Measurements (Brunelli and Poggio et al., 1993)

**Photography:**

Each subject chosen for the study was made to sit comfortably on the stool with back straight and head positioned in eye-ear plane (It is the standard position of the head when two orbitale and 2 porion are in the same plane). The height of the tripod was adjusted so that it was equal with the

height of the subject's face and entire face was visible within the shot. The timer of the camera was used so as to avoid movement in taking the shot. The photographs were taken from a distance of 2 feet (Aksu and Kocadereli et al. 2010) with a Sony Lens G cyber shot 20x optical zoom digital camera in order to get a very clear facial image. The setting of the camera the White balance was set at Fine, Continuous at Single, Image adjustment at Normal, Lens at Normal, Focus at AF area mode (Auto), Aperture at10.3, Shutter speed at 0.25 sec., Zoom at Maximum optical. The photographs were saved in JPEG format and uploaded directly to the software (Adobe Photoshop CS3), with 300 dpi resolution.

## 2. Image Preprocessing:

The photographic records were transferred to the computer with the help of Adobe Photoshop CS3 software was used in image preprocessing; every image has gone through the following steps:

☐ Face image was cropped manually from the side face image of a person.

☐ Cropped face image was resized.

☐ Colored image was converted to gray scale image.

The sizes of cropped face images were different. In order to find same number of features from each frontal face image, resizing the images to unique fixed size of 5x7 inches (1500 x 2100 pixel) were made. Fig. 2-5 demonstrates the output at the end of preprocessing step. Figure.2 (a) shows the original image in the database, figure.3 (b) cropped image, figure.4 (c) resized image and figure.5 (d) gray scale image.
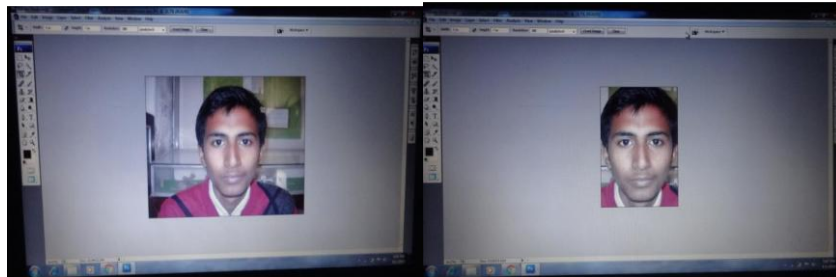


Fig.2: Original image (a)        Fig.3: Corp image (b)
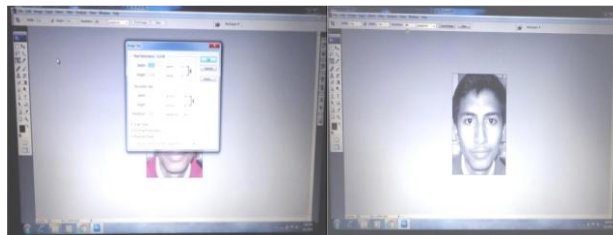


Fig.4: Resized image (c)        Fig.5: Gray scale image (d)

## 3. Normalization:

The face needs to be normalized. To normalize an image, the key facial landmarks must be located accurately i.e., the image must be standardized in terms of size, pose, illumination etc. Light does not impact the normalization process. (Ramchandra and Kumar et al., 2013). The photograph of the frontal face was placed on a development easel and landmarks aligned such as zygion, ectocanthion, endocanthion, cheilion, and alare, was then detected and used as the origin. These landmarks are used to normalize the image and to initialize the method that localizes the facial components (eyes, cheeks, and mouth,) and precisely extracts 5 horizontal facial landmarks, from the frontal images of a face, which was shown in Figure 6. These measurements have been used to distinguish individuals.
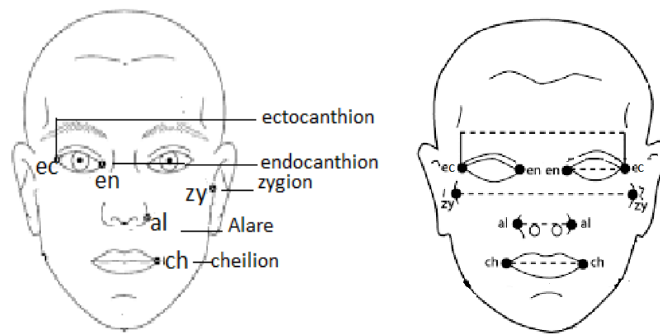


Fig. 6: The location of some of the anatomical landmarks used in facial photometric and The 5 horizontal facial landmarks of frontal face

**Face photometric measurements:**

The facial pictures were carefully scaled using the distances between landmarks in the horizontal plane. These were then equally carefully aligned and lines drawn through as many landmarks as possible. The measurements were taken on the photographs with the sliding caliper and then the possible proportions were worked out from these measurements taken on photograph. 5 measurements between 5 selected landmarks were selected manually and 7 indices were taken and calculated for each subject's photographs from the frontal images.

**Definition of anatomical landmarks used in present study**

| Measurements | Landmarks | Definitions |
|---|---|---|
| Bizygomatic breadth | zy-zy | **Zygion(zy) :-** The most laterally projecting point on the zygomatic arch. The point is determined by measuring the maximum bizygomatic breadth. |

| Interoccular breadth | en-en | **Endocanthion:-** Inner corner of the palpebral opening, medial to the caruncula lacrimalis. |
|---|---|---|
| Binocular breadth | ec-ec | **Ectocanthion:-** Outer corner of the palpebral opening |
| Nasal breadth | al- al | **Alare (al):-** The most external point on the wings of the nose. |
| Mouth breadth | ch-ch | **Cheilion(ch):-** Outer corner of the mouth; lateral terminus of the oral slit. |

(Wilder et al.,1921; Farkas et al., 1984)

Each measurement the smaller dimension as numerator and large dimension as denominator multiplied by 100. The significance of measurements and indices was certainly well understood in understanding the extent of variability and development in certain traits. An index is produced as a follows:

Index = Smaller dimension / Large dimension × 100

The maximum dimension was used as constant denominator and following proportions were worked out.

1. Intercanthal index (ICI) = en-en/ ec-ec×100

2. Biocular nasal width index (BNWI)= ec-ec / al-al×100

3. Intercanthal nasal width index(ICNWI) = en-en/al- al ×100

4. Nose -facial width index (NFWI)= al-al/ zy-zy ×100

5. Nose –mouth width index (NMWI)= al-al/ ch-ch ×100

6. Mouth face width index (MFWI) = ch-ch/ zy-zy ×100

7. Mouth width index (MWI) = ch-ch / ec-ec ×100

Values for each measurement was tabulated and analyzed by SPSS Statistical software 20 version/PC after all the measurements were taken.

**Results**

The Phenotypic variables have been expressed in table no 1 to 8 for Brahmins and Vaishyas male and female of Lucknow Region. The descriptions of both communities are hereby interpreted comparatively as further  distinct phenotypic variables viz. Ethnic variance in different face measurements, Ethnic variance in different face measurements, independent t' Test for variance Indices calculated from different facial measurements, Ethnic differences in various face indices.

Table 1 Comparison of Mean of various facial measurements among Brahmin (males and females)

| S. No | Measurements | Male | | Female | | Value of 't' | P value |
|---|---|---|---|---|---|---|---|
| | | MeanX$_1$ (in cm) | SD X$_1$ | MeanX$_2$ (in cm) | SD X$_2$ | | |
| 1 | zy-zy | 11.51 | 0.44 | 11.67 | 0.33 | -2.97 | 0.00** |
| 2 | en-en | 2.86 | 0.25 | 2.93 | 0.21 | 2.29 | 0.02* |
| 3 | ec-ec | 8.37 | 0.37 | 8.60 | 0.38 | -4.34 | 0.00** |
| 4 | al-al | 3.73 | 0.24 | 3.67 | 0.21 | 1.97 | 0.05* |
| 5 | ch-ch | 4.75 | 0.38 | 4.77 | 0.34 | -0.38 | 0.70 |

Significant at $p<0.05$ level*, Highly Significant at $p<0.001$ level **

In some face measurements the result is non-significant while in majority the result is significant.

It has been observed from the table shows that on average Bizygomatic Breadth of males is ($M=$ 11.51, SD= 0.44) and ($M =$11.67, $SD=$ 0.33) among Brahmin females. Thus, the $t$ value obtained is (-2.97) with $p$ value (0.00**). Hence this difference is highlysignificant as $p$ value is less than 0.001.

Interocular breadth of males is ($M = 2.86$, SD= 0.25) and ($M =$2.93, $SD=$ 0.21) among Brahmin females. Thus, the $t$ value obtained is (2.29) with $p$ value (0.02*). Therefore, this difference is significant as $p$ value is less than 0.05. Binocular breadth of males is ($M = 8.37$, SD= 0.37) and ($M =$8.60, $SD=$ 0.38) among Brahmin females. Thus, the $t$ value acquired is (-4.34) with $p$ value (0.00**). This difference is highly significant since $p$ value is less than 0. 001.Nasal breadth of males is ($M = 3.73$, SD= 0.24) and ($M =$3.67, $SD=$ 0.21) among Brahmin females. Thus, the $t$ value obtained is (1.97) with $p$ value (0.05*). Hence, this difference is significant as $p$ value is less than 0.05.

Table 2: Independent 't-test for different Indices calculated from different facial measurements among Brahmin (male and female) of Lucknow Region for Gender differences

| S.No | Indices | Male | | Female | | Value of 't' | Significant value |
|---|---|---|---|---|---|---|---|
| | | Mean X$_1$ | SD X$_1$ | Mean X$_2$ | SD.X$_2$ | | |
| 1 | ICI | 34.16 | 2.64 | 34.17 | 2.23 | -0.00 | 0.99 |
| 2 | ICNWI | 76.74 | 7.46 | 80.25 | 7.52 | -3.31 | 0.00** |
| 3 | BNWI | 44.67 | 2.75 | 42.74 | 2.63 | 5.06 | 0.00** |
| 4 | NFWI | 32.46 | 2.02 | 31.46 | 1.83 | 3.64 | 0.00** |
| 5 | NMWI | 78.93 | 5.91 | 77.23 | 5.90 | 2.02 | 0.04* |
| 6 | MWI | 56.84 | 4.74 | 55.56 | 4.39 | 1.97 | 0.05 * |
| 7 | MFWI | 41.33 | 3.10 | 40.90 | 3.12 | -0.97 | 0.33 |

Significant at p<0.05 level*, Highly Significant at p<0.001 level **

In some indices the result is insignificant while in majority the result is significant ICNWI has $t$ value (-3.31) with $p$ value (0.00**) among the Brahmin males and females. Therefore, this difference is highly significant as $p$ value is less than 0.001.

BNWI has $t$ value (5.06) with $p$ value (0.00**) among the Brahmin males and females. Thus, this difference is highly significant because $p$ value is less than 0.001.

NFWI has $t$ value (3.64) with $p$ value (0.00**) among the Brahmin males and females. Therefore, this difference is highly significant because $p$ value is less than 0.001.

NMWI has $t$ value (2.02) with $p$ value (0.04*) among the Brahmin males and females. Thus, this difference is significant since $p$ value is less than 0.05.

MWI has $t$ value (1.97) with $p$ value (0.05*) among the Brahmin males and females. Hence, this difference is significant as $p$ value is less than 0.05.

Table - 3 Comparison of mean of various facial measurements among Vaishya (males and females)

| S.No | Measurements | Male | | Female | | Value of 't' | $p$ value |
|------|--------------|------|------|--------|------|------|------|
| | | Mean (in cm) $X_1$ | SD $X_1$ | Mean (in cm) $X_2$ | SD $X_2$ | | |
| 2 | zy-zy | 11.54 | 0.42 | 11.58 | 0.42 | -0.69 | 0.48 |
| 3 | en-en | 2.92 | 0.27 | 2.94 | 0.25 | 0.05 | 0.95 |
| 4 | ec-ec | 8.36 | 0.41 | 8.33 | 0.63 | -0.31 | 0.75 |
| 5 | al-al | 3.83 | 0.27 | 3.62 | 0.25 | 5.78 | 0.00** |
| 9 | ch-ch | 4.82 | 0.33 | 4.60 | 0.34 | 3.30 | 0.00** |

*Significant at $p<0.05$ level, **Highly Significant at $p<0.001$ level

Illustrates the data that has been subjected to test of significance (t-test) in order to access the gender differences in different face measurements among the Vaishya males and females of Lucknow region.

Nasal breadth of Vaishya males is ($M = 3.83$, SD= 0.27) and ($M$ =3.62, $SD$=0.25) among females. Thus, the t value obtained is (5.78) with $p$ value (0.00**). Therefore, this difference is highly significant since $p$ value is less than 0.001.

Mouth breadth of Vaishya males is ($M = 4.82$, SD= 0.33) and ($M$ =4.60, $SD$= 0.34) among females. Thus, the t value acquired is (3.30) with $p$ value (0.00**). This result is highly significant because $p$ value is less than 0.001.

Table 4 Gender differences in different face indices among Vaishya malesand females of Lucknow Region

| S.No | Indices | Male | | Female | | Value of 't' | $p$ value |
|---|---|---|---|---|---|---|---|
| | | Mean $X_1$ (cm) | SD$X_1$ | Mean $X_2$ (cm) | SD $X_2$ | | |
| 1 | ICI | 34.88 | 2.45 | 34.81 | 2.25 | 0.21 | 0.83 |
| 2 | ICNWI | 76.37 | 7.41 | 81.02 | 7.59 | -4.38 | 0.00** |
| 3 | BNWI | 45.88 | 3.25 | 43.15 | 2.86 | 6.30 | 0.00** |
| 4 | NFWI | 33.25 | 2.35 | 31.26 | 2.09 | 6.30 | 0.00** |
| 5 | NMWI | 79.77 | 6.31 | 77.90 | 6.27 | 2.10 | 0.03* |
| 6 | MWI | 57.67 | 3.86 | 55.58 | 3.98 | 3.76 | 0.00** |
| 7 | MFWI | 41.81 | 3.03 | 40.29 | 3.11 | 3.50 | 0.00** |

*Significant at $p<0.05$ level, **Highly Significant at $p<0.001$ level

The significant Facial Proportion indices having $t$ value are: ICNWI of Vaishya males is ($M = 76.37$, SD= 7.41)and ($M =81.02$, $SD=$ 7.59) among females. Thus, the t value obtained is (-4.38)with $p$ value (0.000**), this result is highly significant as $p$ value is less than 0.001

BNWI of Vaishya males is ($M = 45.88$, SD= 3.25) and ($M =43.15$, $SD=$ 2.86) among females. Thus, the t value obtained is (6.30) with $p$ value (0.000**). Hence this difference is highly significant as $p$ value is less than 0.001.

NFWI of Vaishya  males is ($M = 33.25$, SD= 2.35) and ($M =31.26$, $SD=$2.09) among females. Thus, the t value obtained is (6.30) with $p$ value (0.000**), Hence this difference is highly significant as $p$ value is less than 0.001.

 NMWI of Vaishya males is ($M = 79.77$, SD= 6.31) and ($M =77.90$, $SD=$ 6.27) among females. Thus, the t value obtained is (2.10) with $p$ value (0.03*), therefore this difference is highly significant as $p$ value $p<0.001$.

MWI of Vaishya males is ($M = 57.67$, SD= 3.86) and ($M =55.58$, $SD=$ 3.98) among females. Thus, the t value obtained is (3.76) with $p$ value (0.000**), $p <0.001$.

MFWI of Vaishya males is ($M =41.81$, SD= 3.03) and ($M =40.29$, $SD=$ 3.11) among females. Thus, the t value obtained is (3.50) with $p$ value (0.000**). Hence this difference is highly significant as $p$ value is $< 0.001$.

Table 5: Ethnic variance in different face measurements among Brahmin and Vaishya males of Lucknow Region

| S. No | Measurements | Brahmin Males | | Vaishya males | | Value of 't' | P value |
|---|---|---|---|---|---|---|---|
| | | Mean X$_1$ (cm) | SD X$_1$ (cm) | Mean X$_1$ (cm) | SD X$_1$ (cm) | | |
| 1 | zy-zy | 11.51 | 0.44 | 11.54 | 0.42 | -0.48 | 0.62 |
| 2 | en-en | 2.86 | 0.25 | 2.92 | 0.27 | -1.62 | 0.10 |
| 3 | ec-ec | 8.37 | 0.37 | 8.36 | 0.41 | 0.01 | 0.98 |
| 4 | al-al | 3.73 | 0.24 | 3.83 | 0.27 | -2.73 | 0.00** |
| 5 | ch-ch | 4.75 | 0.38 | 4.82 | 0.33 | -1.36 | 0.17 |

*Significant at $p<0.05$ level, **Highly Significant at $p<0.001$ level.

Table 5- illustrates the data that has been subjected to test of significance (t-test) in order to access the Ethnic differences in different face measurements among the Brahmin and Vaishya males of Lucknow region. In some measurements the result is significant while in majority the result is non-significant.

Among Brahmin and Vaishya males, the ethnic differences are significant at $p<0.05$ for facial proportion measurements for Nasal Breadth of Vaishya males is (*M* =3.83cm, *SD=0.27*) and (*M* = 3.73cm, SD= 0.24) among Brahmin males. Thus, the *t* value found is (-2.73) with *p* value (0.00**). This result is highly significant because *p* value is less than 0.001.

Table 6: Ethnic variance in different face measurements among Brahmin and Vaishya females of Lucknow Region

| S.No | Measurements | Brahmin females | | Vaishya females | | Value of 't' | *P* value |
|---|---|---|---|---|---|---|---|
| | | Mean X$_1$ (cm) | SD X$_1$ (cm) | Mean X$_1$ (cm) | SD X$_1$ (cm) | | |
| 1 | zy-zy | 11.67 | 0.33 | 11.58 | 0.42 | 1.71 | 0.08 |
| 2 | en-en | 2.93 | 0.21 | 2.92 | 0.25 | 0.53 | 0.59 |
| 3 | ec-ec | 8.60 | 0.38 | 8.38 | 0.39 | 3.88 | 0.00** |
| 4 | al-al | 3.67 | 0.21 | 3.62 | 0.25 | 1.58 | 0.11 |
| 5 | ch-ch | 4.77 | 0.34 | 4.66 | 0.34 | 2.23 | 0.02* |

Significant at p<0.05 level, ** Highly Significant at p<0.001 level.

Table-6. presents the data that has been subjected to test of significance (t-test) in order to access the Ethnic differences in different face measurements among the Brahmin and Vaishya females of Lucknow region. In some measurements the result is significant while in majority the result is non-significant.

Among Brahmin and Vaishya females, the ethnic differences are significant at p<0.05 for facial proportion measurements for Binocular breadth of Brahmin females is (M = 8.60 cm, SD= 0.38) and (M =8.38 cm, SD=0.39) among Vaishya females. Thus, the t value obtained is (3.88) with *p* value (0.00**). Hence this difference is highly significant since *p* value is less than 0.001.

Mouth breadth of Brahmin females is (M = 4.77 cm, SD= 0.34) and (M =4.66 cm, SD=0.34) among Vaishya females. Thus, the t value obtained is (2.23) with *p* value (0.02*). Hence this difference is significant since *p* value is less than 0.05.

Table 7: Independent 't' Test for variance Indices calculated from different facial measurements among Brahmin and Vaishya males of Lucknow Region for Ethnic differences

| S.No | Indices | Brahmins Male | | Vaishyas Male | | Value of 't' | *p* value |
|------|---------|---------------|--------|---------------|-------|------|---------|
| | | Mean $X_1$ | SD $X_1$ | Mean $X_2$ | SD $X_2$ | | |
| 1. | ICI | 34.16 | 2.64 | 34.88 | 2.45 | -1.99 | 0.08 |
| 2. | ICNWI | 76.74 | 7.46 | 76.37 | 7.41 | 0.35 | 0.72 |
| 3. | BNWI | 44.67 | 2.75 | 45.88 | 3.25 | -2.82 | 0.00** |
| 4. | NFWI | 32.46 | 2.02 | 33.25 | 2.35 | -2.55 | 0.01* |
| 5 | NMWI | 78.93 | 5.91 | 79.77 | 6.31 | -0.97 | 0.33 |
| 6 | MWI | 56.84 | 4.74 | 57.67 | 3.86 | -1.35 | 0.17 |
| 7 | MFWI | 41.33 | 3.10 | 41.81 | 3.03 | -1.10 | 0.27 |

*Significant at *p*<0.05 level, **Highly Significant at *p*<0.001 level.

Table 7- illustrates the data that has been subjected to test of significance (t-test)in order to access the Ethnic differences in different face indices among the Brahmin and Vaishya males of Lucknow region. In some indices the result is significant while in majority the result is non-significant. Among Brahmin and Vaishya males, the ethnic differences are significant at p<0.05 for facial proportion indices for BNWI of Vaishya males is (*M* =45.88, *SD*=3.25) and (*M* = 44.67, SD= 2.75) among Brahmin males. Thus, the *t* value obtained is *t* (-2.82) with *p* value (0.00**). Therefore, this difference is highly significant as *p* value is less than 0.001.

NFWI of Vaishya males is ($M$ =33.25, $SD$=2.35) and ($M$= 32.46, SD= 2.02) among Brahmin males. Thus, the $t$ value obtained is (-2.55) with $p$ value (0.01*). This result is therefore significant as $p$ value is less than 0.0

Table 8- Ethnic differences in various face indices among Brahmin and Vaishya Females of Lucknow Region

| S.No | Indices | Brahmin Females | | Vaishya Females | | Value of t | $P$ value |
|---|---|---|---|---|---|---|---|
| | | Mean $X_1$ | $SD_1$ | Mean $X_2$ | $SD_2$ | | |
| 1 | ICI | 34.17 | 2.23 | 34.81 | 2.25 | -2.03 | 0.04* |
| 2 | ICNWI | 80.25 | 7.52 | 81.02 | 7.59 | -0.72 | 0.47 |
| 3 | BNWI | 42.74 | 2.63 | 43.15 | 2.86 | -1.03 | 0.30 |
| 4 | NFWI | 31.46 | 1.83 | 31.26 | 2.09 | 0.72 | 0.46 |
| 5 | NMWI | 77.23 | 5.90 | 77.90 | 6.27 | -0.76 | 0.44 |
| 6 | MWI | 55.56 | 4.39 | 55.58 | 3.98 | -0.03 | 0.97 |
| 7 | MFWI | 40.90 | 3.12 | 40.29 | 3.11 | 1.39 | 0.16 |

*Significant at $p<0.05$ level, **Highly Significant at $p<0.001$ level.

Table 8- demonstrates the data that has been subjected to test of significance (t- test) in order to access the Ethnic differences in different face indices among the Brahmin and Vaishya Females of Lucknow region. In some indices the result is significant while in majority the result is non-significant.

Among Brahmin and Vaishya females, the ethnic differences are significant at p<0.05 for facial proportion indices for ICI of Brahmin females is ($M$ = 34.17, SD= 0.23) and ($M$ =34.81, $SD$=2.25) among Vaishya females. Thus, the $t$ value obtained is (-2.03) with $p$ value (0.04*). Hence this difference is significant since $p$ value is less than 0.05.

**Discussion**

The present study provides us with the personal identification on the basis of photographic metrically. For this two endogamous caste groups of Lucknow region Brahmins and Vaishyas of Uttar Pradesh were chosen from the population. The data related to the various indices of face biometrics can be compared with the studies done earlier to arrive at any conclusion.

The present study, which was carried out on 400 subjects, 200 Brahmins and 200 Vaishyas (100 males and 100 females each) under the age group of 18-40 year for 7face indices of frontal face were considered and the overall accuracy achieved through all statistically significant Facial

proportion indices was 87.8%. The total cumulative variance is 86.4% for Brahmin males, 87.5% for Brahmin females, 88.4% for Vaishyas male, 89.1% for Vaishyas female. So, the result of the present study shows approx similarity with the result of Ivancevic, & Sunde study.

Aksua et al., (2010) in their work Reliability of reference distances used in photogrammetry have presented the values of various measurements. To obtain the mean value for Ex-Ex was (9.40±0.36 cm) males, (9.10 ±0.36cm) females and en-en (3.41± 0.23cm) males and (3.30± 0.26cm) females, al-al (3.94 ± 0.27cm) males, (3.57 ±0.23) females, ch-ch (5.29 ± 0.32cm) males and (4.97± 0.37cm) females. While in the present study, the result showed the mean values for ec-ec, en-en, al-al, ch-ch was (8.37±0.37cm), (2.86±0.25cm), (3.73±0.24), (4.75±0.38m) respectively in Brahmin males, On the other hand in Brahmin females these values were respectively, (8.60±0.38cm), (2.93±0.21cm), (3.67±0.21cm), (4.77±0.34cm). However, in Vaishya males these values were respectively (8.36±0.41cm), (8.36±0.4cm), (12.92±0.27cm), (4.55±0.39cm), (5.64±0.50cm), (3.83±0.27cm), (4.82±0.33cm), However in Vaishya females these values were respectively (8.33±0.63cm), (2.94±0.25cm), (4.65±0.36cm), (5.41±0.43cm), (3.62±0.25cm), (4.60±0.34cm) these measurements were found statistically significant for sex differences among Brahmin and Vaishya communities of Lucknow region. Therefore, the result of the present study shows similarity with the result of Aksua study.

Morosini et al., (2012) in their work Study of face pleasantness using facial analysis in standardized frontal photographs have presented the values of various measurements and indices. The sample consisted of frontal and lateral standard facial photographs, in natural head position, of 85 Brazilian Caucasian women to obtain mean values were Facial index: (84.70, SD 3.59), en-en (3.35cm SD 0.25), al-al (3.63cm SD0. 31), ch-ch (5.02cm SD 3.75). However, under the present study, which was carried on 400 subjects, 200 Brahmins and 200 Vaishyas (100 male and 100 female) under the age group of 18-40 year for 13 face measurements of frontal face were considered and obtain mean values were Interocular breadth is (2.93cm, SD 0.21± 0.02) among Brahmin females and Vaishya females (2.92cm, SD 0.25± 0.02). The mean value for Nasal breadth is (3.67cm, SD 0.21±0.02) Brahmin females and Vaishya females (3.62cm, SD 0.25±0.02). The mean value for Mouth breadth is (4.77 cm, SD 0.34±0.03) Brahmin females and Vaishya females (4.60cm, SD 0.34±0.03). Brahmin females and Vaishya females (0.50 cm, SD 0.14±0.01). So, the result of the present study shows similarity with the result of Morosini study.

Kalra et al., (2015), in their work Evaluation of various anthropometric proportions in Indian beautiful faces: A photographic study has presented the values of various indices. Frontal photographs of 30 females. The frontal face indices of results showed the mean values for ICNWI, NMWI, MFWI was respectively, (86.01 ±7.03cm), (69.86±6.40cm), (37.63± 3.02cm) for frontal face in the young women.   However, in the present study, the results showed the mean and t test values for ICNWI, NMWI, MFWI is respectively, (80.25±7.52cm), (77.23±5.90cm), (40.90±3.12cm) for frontal faces in Brahmin females. Similarly, in Vaishya females these values are respectively, (87.07±5.18cm), (78.15±7.78cm), (40.29±3.11cm) for frontal faces these indices are found statistically significant for interpopulation differences among Brahmin and Vaishya communities of Lucknow region. Thus, the result of the present study shows similarity with the result of Kalra study.

Negi et al., (2017) in their work Photogrammetric Correlation of Face with Frontal Radiographs and Direct Measurements have presented the values of various measurements. The study was conducted on 30 subjects of Indian origin. Standardized frontal photographs were obtained from subjects in the age group of 18-25 years and to obtain mean values are en-en (3.16cm, SD 0.39±0.12), ex-ex (9.54cm, SD 0.45±0.14), zy-zy (12.1cm, SD 0.64±0.20), al-al (3.52cm SD 0.37±0.11). While in the present study, which was carried on 400 subjects, 200 Brahmins and 200 Vaishyas (100 male and 100 female) under the age group of 1840 year for 13 facial measurements on Standardized frontal facial photographs. The mean value for Interocular breadth is (2.86cm SD 0.25±0.02) among Brahmin males and Brahmin females (2.93cm, SD 0.21± 0.02). Vaishya males (2.92cm, SD0.27±0.02) and Vaishya females (2.92cm, SD 0.25± 0.02). The mean value for Binocular breadth is (8.37cm, SD 0.37±0.03) Brahmin males, (8.60cm, SD 0.38±0.03) Brahmin females. (8.36, with SD 0.41±0.04) Vaishya males (8.33cm, SD0.63±0.06) Vaishya females. The mean value for Bizygomatic Breadth is (11.51cm, SD 0.44±0.04) Brahmin males and Brahmin females (11.67cm, SD0.33±0.03). Vaishya males (11.54cm, SD 0.42±0.04) and Vaishya females (11.58 cm, SD 0.42±0.04). The mean value for Nasal breadth is (3.73cm, SD 0.24± 0.02) Brahmin males. (3.67cm, SD 0.21±0.02) Brahmin females.

**Conclusion**

Among all the biometric techniques, face recognition approach possesses one great advantage, which is user-friendliness (non-intrusiveness). All the issues and challenges of personal identification can be solved by different algorithms from the facial biometric.

After the analysis of mean values data were subjected to test of significance (t-test) to assess the gender differences among the Brahmins and Vaishyas communities of Lucknow. Test of significant (t-test) at the level of $p<0.05$ revealed significant gender differences (Intrapopulation) for photometric measurements among the Brahmin (males and females) except for Bizygomatic Breadth ($P$value = 0.00), Interocular breadth ($P$value = 0.02), Binocular breadth (0.00), Nasal breadth ($P$value = 0.05), which are observed significant among male and female Brahmins.

Test of significant (t-test) at the level of p<0.05 revealed significant gender differences (Intrapopulation) for facial photometric measurements among the Vaishya (males and females) for Nasal breadth ($P$value = 0.00), Mouth breadth ($P$value = 0.00), which are observe significant among Vaishya males and females.

After the analysis of mean values data were subjected to test of significance (t-test) to assess the gender differences among the Brahmins community of Lucknow. Test of significant (t-test) at the level of $p<0.05$ revealed significant gender differences (Intrapopulation) for facial proportion indices among the Brahmin (males and females) for ICNWI ($P$value =0.00), BNWI ($P$value = 0.00), NFWI ($P$value = 0.00), NMWI ($P$value = 0.04), MWI ($P$value = 0.05), which are seen to be significant among males and females Brahmin.

Test of significant (t-test) at the level of $p<0.05$ revealed significant gender differences (Intrapopulation) for facial proportion indices among the Vaishyas (male and female) for ICNWI ($P$value = 0.00), BNWI ($P$value = 0.00), NFWI ($P$value = 0.00), NMWI ($P$value = 0.03), MWI ($P$value = 0.00), MFWI ($P$value = 0.00), which are observed significant among male and female Vaishyas.

Test of significant (t-test) to access the ethnic differences among Brahmins and Vaishyas male of Lucknow region. It is apparent from the values of t-test that the ethnic differences are significant at the level of $p<0.05$ in the facial proportion indices for ICNWI ($P$value = 0.00), NFWI ($P$value = 0.01), which are seen significant among males Brahmins and Vaishyas.

Among Brahmins and Vaishyas females, the ethnic differences are significant at $p<0.05$ for facial proportion indices for ICI ($P$value = 0.04), which are seen to be significant among females, which are seen to be significant.

In this research the rare and common facial characteristics in communities of Brahmins and Vaishyas of Lucknow region were identified. The result is compared with several statistical techniques such as mean, range, t test, and proposed technique gives a better recognition rate than

the other techniques. The 't' tests revealed intrapopulation and interpopulation significant difference in most of the measurements, indices. Hence face of a person holds utmost importance and it should be studied first of all because the human face is the reflection of individual uniqueness of a person.

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# Challenging with the Challenged: The Situation of the Caregivers of the Specially-Abled Children in Thiruvananthapuram, Kerala-India

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**Abstract**

Mental retardation is a condition that can be either present since birth or acquired at a later stage in life. The life of a child consists of enormous challenges and difficulties from birth to later stages of life. Behind every one of them exists their caretakers, mostly their parents or other close acquaintances, in instances where one might have lost their parents under any circumstances. Children with special needs require special care and assistance, which often serves as a task for their caregivers. The objective of this study is to examine the numerous challenges and experiences of the caregivers of the specially-abled children of Kerala, employing an exploratory research design and utilising qualitative data collected through case studies. The findings indicate that the caregivers experience depression and anxiety because of their occupational stress and taking care of the special-abled. Depression and anxiety are common challenges in the lives of caretakers of the specially-abled children. The prevalence of depression in the caretakers of the female, specially-abled children was observed to be higher than in the caretakers of the male children. The caregivers of the specially-abled face numerous challenges, such as exclusion, stigma, and depression, and these problems need social recognition and governmental programmes and policies.

**Keywords:** mental retardation, caregiving, specially-abled children

## 1. Introduction

Children with disabilities, often referred to as children with special needs, experience developmental, intellectual, sensory, physical, or a combination of these challenges. The term children with special needs or children with disabilities is more commonly and politely used (Qureshi et al., 2021). It is crucial to recognise that disability extends beyond a mere medical condition; it often arises from the interaction between an individual's impairment and various institutional, environmental, and behavioural barriers that hinder their full and effective participation in society (Murphy et al., 2006). The development of children with special needs, encompassing physical, emotional, social, and educational dimensions, is significantly supported by their caregivers. The demands of their roles, united with the responsibility of caring for individuals with disabilities, often lead caregivers to experience anxiety and

depression. Those who care for children with special needs frequently face challenges such as depression, stigma, and marginalization. This study aims to explore the challenges and experiences of caregivers of children with disabilities.

## 2. Literature Review

### 2.1 Specially-abled: An overview

Disabilities manifest at different stages of the development of a child and in various forms. Common categories of disabilities include cerebral palsy, Muscular Dystrophy, spina bifida, limb deformities, visual impairment, blindness, developmental disabilities, and autism spectrum disorder, among others (Qureshi et al., 2021). In the current social order, children with disabilities often face numerous hurdles. The most significant challenges for children with special needs are social stigma and discrimination. Families and children with disabilities frequently encounter negative stereotypes, rejection, and even abuse, leading to social exclusion and the denial of basic rights (Cleary, 2003).

Children with disabilities often struggle to access many public spaces, transportation systems, educational institutions, and buildings due to the absence of ramps, elevators, accessible restrooms, and other necessary changes (Murphy et al., 2006). There is a significant shortage of trained special educators and support staff, and many mainstream schools lack the resources, qualified teachers, and adapted programs needed to educate students with diverse needs (Murphy et al., 2006).

Healthcare facilities are often ill-equipped with the tools and personnel required to address the unique needs of children with disabilities. For many families, the high cost of specialised care and therapies presents another major challenge (Pankajam, 2009). Families with children with disabilities are disproportionately more likely to experience poverty due to the higher costs of care, limited access to education, and fewer employment opportunities for caregivers. Children with disabilities are also at a higher risk of experiencing abuse, neglect, exploitation, and violence (Bhowate and Dubey, 2005).

### 2.2 Global Context

UNICEF estimates that around 240 million children globally, which is about 10% of the child population of the world, have disabilities, making them a notable minority. The occurrence and nature of these disabilities differ across regions and countries due to factors like early detection systems, environmental conditions, conflict, healthcare access, and nutrition (Dalton et al., 2020). In many developing nations, children with disabilities often remain unnoticed because of stigma, insufficient data, and their exclusion from social records and

services. Despite global initiatives, these children frequently face significant and interconnected challenges (Scorza et al., 2013). Stigma and discrimination are widespread issues worldwide. Negative perceptions, biases, and misunderstandings about disabilities result in social exclusion, isolation, and a lack of opportunities (Higgins & Kruglanski, 2008). In severe cases, this can lead to institutionalisation or infanticide. There is a strong relationship between poverty and disability. Families with disabled children are more likely to experience poverty due to the costs of care, loss of income, and other related expenses (Kawanishi, 2009). Children with disabilities are among the most vulnerable and marginalised in emergencies and conflict zones. They often lose access to caregivers, medication, and assistive technology, and face a higher risk of violence and being denied humanitarian aid. The exclusion of these children from policy-making and resource distribution is often due to the lack of reliable, de-identified data (Andersson et al., 2023). Article 23 of the United Nations Convention on the Rights of the Child specifically addresses the rights of children with physical or mental disabilities to live full and dignified lives, characterised by dignity, independence, and active community involvement (Das, 2022). The United Nations Convention on the Rights of Persons with Disabilities is the most important international human rights treaty for people with disabilities, promoting a shift from a medical or charity model of disability to a human rights model (Das, 2022).

### 2.3 Indian Scenario

India has achieved notable progress in legal and policy measures to safeguard the rights of children with disabilities. The country revised the Persons with Disabilities Act of 1995 by enacting the landmark Rights of Persons with Disabilities Act of 2016. The legislation ensures inclusive and free education, protection from abuse, violence, and exploitation, as well as provisions for reservation, legal capacity, guardianship, and accessibility in both public and private spaces (Roy et al., 2019).

According to the Right of Children to Free and Compulsory Education Act of 2009, all children between the ages of 6 and 14, including those with disabilities, have the right to free and compulsory elementary education. This law guarantees access to special education, free school admission, and accessible facilities (Hazra & Bala, 2025). Furthermore, the Mental Healthcare Act of 2017 ensures the right to treatment in mental hospitals, with specific provisions for separate accommodations for minors under 18 and the state government's responsibility for treatment costs, unless covered by the family (Hazra & Bala, 2025). The Indian government carries out various programs and initiatives, mainly through the

Department of Empowerment of Persons with Disabilities, which is part of the Ministry of Social Justice and Empowerment (Hazra & Bala, 2025). Despite these significant advancements, challenges remain in raising public awareness, ensuring fair access to quality services, and combating widespread societal stigma. To enable children with intellectual disabilities in India to live independent, fulfilling, and dignified lives, all stakeholders must persist in their collaborative efforts.

### 3. Research Methodology

This study aims to investigate the various challenges and experiences faced by caregivers of children with special needs in Kerala. This research employs an exploratory design and utilises qualitative data obtained through case studies. Fieldwork was conducted at Asha Deepam Buds School, Malayinkeezhu, Thiruvananthapuram, Kerala. The parents of the specially-abled children from the Asha Deepam Buds School constitute the study population. Purposive sampling was employed to select the case studies, and pseudonyms were used to ensure the privacy of the respondents.

### 4. Conceptual Framework

The physical, emotional, social, and educational growth of the specially-abled children is supported by their caregivers. Their roles, tied with the responsibility of caring for individuals with disabilities, often result in caregivers experiencing anxiety and depression. The caregivers of children with special needs face challenges such as depression, stigma, and marginalisation. The current study aims to evaluate the challenges and experiences of the caregivers of the specially-abled children.
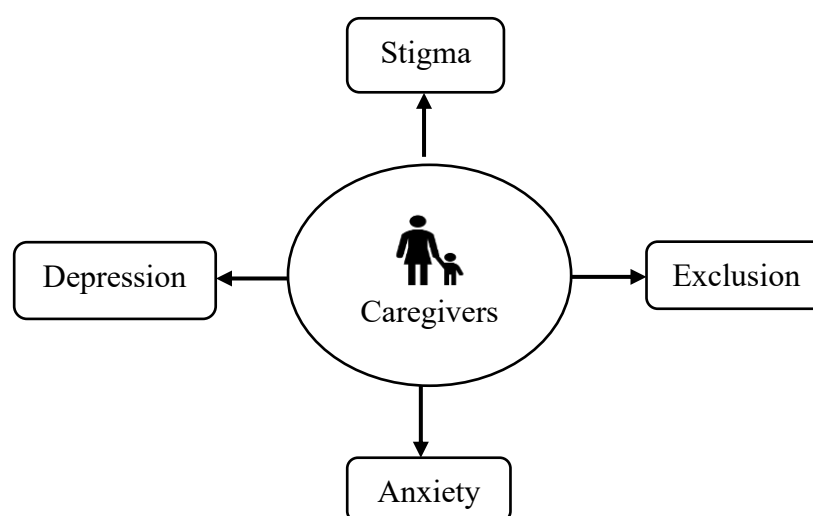


(Source: Own formulation based on findings)

## 5. Depression and Anxiety

Children with disabilities necessitate special care, which often presents a significant responsibility for their caregivers. The quality of care afforded to these children is influenced by the psychological well-being of the caregivers. It is common for caregivers or parents of children with disabilities to encounter psychological challenges as they contemplate the future of the child, associated difficulties, and life beyond the caregivers' presence. Furthermore, the presence of a child with mental disabilities can affect siblings and familial relationships, extending beyond the parents alone.

Factors such as age, gender, level of disability, as well as social class, economic status, and family coping mechanisms, such as acceptance of the child's diagnosis and perception of stigma associated with the disorder, significantly impact the stress experienced by the caregivers. Assuming the role of a caregiver necessitates the adoption of new responsibilities, requiring the reorganisation of priorities and redirection of energy. Consequently, caregivers should remain vigilant for any alterations in their mental state, such as increased irritability, dissatisfaction, depression, confusion, or other indicators of declining mental health.

The experience of children with special needs presents significant challenges, and the role of caregivers is of paramount importance. Concerns regarding the prospects of their child, a perceived loss of personal autonomy due to the condition of the child, a lack of recreational activities or outdoor engagements, economic instability, feelings of isolation and stigmatisation, and increased illness or behavioural differences in the child contribute to elevated stress levels among caregivers. This stress frequently shows as anxiety, which is expressed through symptoms such as fatigue, impaired concentration, racing or intrusive thoughts, hypervigilance or irritability, excessive worry, fear, a sense of impending doom, insomnia, nausea, palpitations, or trembling.

Mostly, caregivers are women, often housewives or individuals who have left their jobs to care for a child. The demands of household duties and managing family affairs frequently prevent them from finding personal time. Consequently, they do not experience the same pleasures or happiness as their peers who are parents of normal children.

> *Daisy (pseudonym), 64 years, said,*
>
> *(" These days I never get time to rest, even to watch TV. Every time I need to be with her, taking care that she does not destroy the things around, I rarely find any time to rest... I used to find time for myself and other household*

*chores when she went to school. With schools being closed at that time, I*

*faced the worst".*

The narrative highlights the level of patience required of a caregiver. The caregiver finds it challenging to enjoy their time or to spend time in front of the television, which serves as a primary source of solace for many older housewives. Thus, the continuous engagement in demanding tasks and the absence of entertainment can render one's mind like a deserted room. The psychological and emotional challenges faced by caregivers include distressing thoughts, emotional disturbances, unavoidable situations, and communication difficulties. A significant concern of the caregivers is the future well-being of the child, stemming from the child's inability to fulfil personal needs, which include developmental tasks expected at certain ages, such as brushing teeth, toileting, dressing, and eating.

The severity of mental retardation can lead to varying levels of depression in the caretakers. It was observed that the prevalence of depression was high in caretakers of children with severe mental retardation or disability. Meanwhile, among caretakers of children with moderate and mild mental disability, the level of depression was found to be low. Thus, the severity of mental retardation, clubbed with any further bodily disability, can be considered as a factor that impacted the depression level of the caretakers. However, the results were varying too.

**Table 5.1 Level of depression**

| Respondents | The IQ level of the child | Level of depression |
|---|---|---|
| A | 30 | Severe depression |
| B | 38 | Moderate depression |
| C | 40 | Severe depression |
| D | 28 | Mild mood disturbance |
| E | 65 | Mild mood disturbance |
| F | 45 | Borderline clinical depression |
| G | 63 | Moderate depression |
| H | 39 | Severe depression |
| I | 60 | Moderate depression |
| J | 25 | Severe depression |

(Source: Own Formulation Based on Findings)

Out of the 10 respondents, four of them were diagnosed as having severe depression with a scores of 32 and 31 in the Beck Depression Inventory Scale. Three of them were diagnosed as having moderate depression with a scores of 26,22, and 21. Two of them were observed to be suffering from mild mood disturbances with a score of 15 each, and one was diagnosed with Borderline Clinical Depression, with a score of 19.

Jacob (pseudo name), 65 years said,

" *How will he survive after our lives? That remains a crucial question in front of me. He needs support in all spheres and activities of his life, like a small child. From awakening him to making him lie down in the bed, either mine or his mom's hands are needed for help. Until my other son's marriage, I strongly believed that he would take care of my child. But things have changed now, and he is busy with his affairs. However, my daughter claims to take care of him, but that is not a reliable solution, as per I as she lives in another family. This thought always creates in us an emotional grievance."*

The following narrative reflects the concerns of a father experiencing significant tension and anxiety regarding his son's future. Given that disability transcends gender, all respondents expressed similar anxieties. Caregivers, in particular, were troubled by the demanding nature of caregiving responsibilities, which necessitate substantial effort and constant availability to meet the child's needs. Concerns were also raised about ensuring the child's care and security following the parent's demise.

Despite having prior knowledge of the consequences of the condition, it remains a critical concern for all caregivers. The condition can induce significant behavioural changes in the specially-abled children, mainly negative, leading to increased stress and depression in the household. The financial burden associated with purchasing additional medications and covering medical expenses or emergencies is often substantial for many families. The trauma and vulnerability of the child to seizures instil fear in the caregivers, exacerbating their anxiety. The respondents confirmed that their child was vulnerable to seizures, with some sharing the distressing impacts of this condition.

Tara (pseudonym), 59 years, said:

 *"After the occurrence of a seizure, she has been continuously administered medicines for the same. And we witnessed gruesome behavioural changes*

*in her. We were so sad and depressed because until then, she had never*

*caused us any trouble."*

Several respondents stated experiencing challenges with a specially-abled child. They express significant stress due to the child's overt misbehaviour, which not only distressed the parents but also affected the neighbours. The respondents were particularly concerned about the child's behaviour when it manifested as violence, destructiveness, restlessness, or hyperactivity, resulting in noise and disturbances.

Siona (pseudonym), aged 50 years, said:

*"I always feel an agony deep inside me whenever I see her being seated*

*alone with her thoughts and the other two children playing, studying, and*

*engaging in other activities. I always expected that some development*

*would occur, but it did not."*

Depression and anxiety are prevalent among caregivers. Notably, the incidence of depression is higher among caregivers of female children with intellectual disabilities compared to those caring for male children. This suggests that the gender of the child significantly influences the level of depression experienced by the caregiver. The pain experienced by caregivers stems from high expectations placed on their children, comparisons of their children's deficits and behaviours with those of typically developing children, perceptions of the irreversibility or culmination of the disability, irrational beliefs that the condition is a divine punishment for past transgressions, and concerns about the future. These factors contribute to increased stress and anxiety, which lead to depression. Additionally, it was observed that the COVID-19 pandemic and the related lockdown, which resulted in behavioural changes in the children, further worsened the mental health challenges faced by caregivers.

The persistent concerns regarding recurrent illnesses and evolving behavioural patterns significantly impact the emotional well-being of caregivers. Factors such as loss of appetite, irregular sleep patterns, and the absence of recreational facilities, compounded by the child's disability, undermine the caregivers' positivity. This situation often results in emotions such as sorrow, agony, fatigue, disinterest, impaired decision-making abilities, and weakened self-esteem and satisfaction.

## 6. Social exclusion and stigma

The issue of social exclusion of the specially-abled is exacerbated by societal attitudes and behaviours that hinder their ability to fully contribute to society. Similarly, caregivers also experience exclusion. Society often perceives those with special needs as distinct from others.

Their unique modes of interaction, spontaneous conversations, and physical appearance, often influenced by their disabilities, contribute to the stares and comments they receive. While such instances may cause minor disturbances for the specially-abled children, and can also significantly impact their caregivers.

Mr. Jacob (pseudonym), 65 years said:

*"The public viewed him as something strange and different. Wherever we went, people used to stare at us. At first, we felt some insecurities about it, but later we got used to it. Some came and asked about what was happening with him. My wife always had tears for them, and that was the only thing she knew. A mother is the one who is always more concerned about her child than the father. So, I answered them.*

This observation highlights the vulnerability of both individuals with disabilities and their caregivers in public settings. Such scrutiny can sometimes lead to feelings of intimidation. The indifference displayed by individuals towards those with disabilities renders them susceptible to mockery, teasing, and harassment. This behaviour indicates a lack of awareness among the individuals who perceive disabilities as humorous.

Shyla (pseudonym), 57 years said:

*"It was so uneasy to handle him. When out, people used to come and ask us why he was yelling. What is his actual problem? Etc. Some people moved away disgustingly as his saliva would fall off his mouth as he kept his mouth open most of the time. This happened especially in buses. People would jump*

*away from the nearby seat, saying, "disgusting." I suffered a lot."*

The statement highlights the insecurity and exclusion experienced by a caretaker while utilising public transportation. A common issue faced by many caretakers is the abrupt distancing by others upon observing the behavioural differences of individuals with disabilities. Economic constraints often prevent the caretakers from hiring taxis or owning a vehicle, compelling them to rely on public transportation as their sole option. The most prevalent exclusionary practices include avoidance, rejection, bullying, and harassment. Children with disabilities frequently encounter derogatory remarks such as 'slow,' 'stupid,' 'insane,' 'crippled,' and 'handicapped.' Additionally, there have been instances where educators have attempted to avoid students with disabilities, specifically encouraging parents to express concerns to the school principal regarding their children attending classes with a disabled

student. Consequently, students with certain levels of IQ have been compelled to transfer to another school.

Jaya (pseudonym),63, said:

*"Even today, he knows whatever he has learned. But, unfortunately, the teachers in his first school never wanted him there. They held a council meeting and informed us that they could not let him study there any further, as some parents had raised issues with the behavioural differences of Vishnu and the concerns about their children sharing the classroom with him. Following which, we admitted him to the Buds School."*

The statement reflects the experiences of a mother who was compelled to discontinue providing her child with access to quality education, like that received by others. Children with disabilities frequently encounter exclusion within educational settings due to their physical and cognitive impairments. Educators often fail to recognise the unique challenges faced by these children. Consequently, even those with mild intellectual disabilities struggle to integrate with their peers.

Caregivers have reported instances where their children were treated less favourably than their non-disabled counterparts. Examples include being required to pay additional fees for the education of their child, being informed that their children could only attend school for a limited time in a day, or that their right to education was contingent upon the availability of teacher support. Furthermore, these children were subjected to discrimination, being labelled with derogatory terms such as 'idiots' or 'stupid.' Additional concerns include exclusion from the curriculum and school activities, as well as experiencing bullying, often perpetrated by teachers.

Siona (pseudonym),50 years old, said:

*"Sania is quite different compared to other children at the school. She will scream and strike her head on the wall or with her bare hands and all. Also, at times, due to her behavioural instability, she had beaten a few children. And their parents complained to me either in a parent meeting or the teacher would call me up to inform me that so and so had complained about Saniya's acts. So, when it comes to parents' meetings, I have a thought inside me that at least some of them have complained about my child. This creates an insecurity and a sense of exclusion in me."*

The statement reflects the experiences of a caregiver who perceives a sense of exclusion among fellow caregivers. As the parent of a child with severe intellectual disabilities, Siona has encountered numerous grievances from other parents at the school, as well as from teachers who, at times, were compelled to relay these concerns. This situation has often resulted in a sense of isolation for her. According to Siona, she has been susceptible to remarks from other parents, and the lack of understanding, coupled with the feeling of not being accepted and her child being perceived as different within the peer group, has engendered feelings of loneliness and exclusion.

## 7. Discussion

With one exception, all respondents were female or mothers of children with intellectual disabilities, aged between 50 and 65 years. Half of the participants identified with the Hindu community, while the other half identified as Christian. All but two respondents had attended school; of these, two discontinued their education in the fourth and eighth grades, respectively, while the remainder achieved a minimum qualification of the Secondary School Leaving Certificate (SSLC) in the tenth grade, with three pursuing further education. One individual resided in a semi-urban area, whereas nine were from rural areas within the district. All respondents, except one, owned their residences. The income of the respondents varied, with two earning between Rs 80,000 and Rs 1,000,000, while the remainder earned Rs 1,000,000 or more.

Caregivers of children with intellectual disabilities often experience depression and anxiety. Research findings indicate that caregivers of female children exhibit a higher prevalence of depression compared to those caring for male children with similar conditions.

This finding suggests that the gender of the child influences the level of depression of the caregivers. Factors contributing to caregivers' distress include high expectations for children with intellectual disabilities, comparisons with typically developing children, perceptions of the disability's permanence, irrational beliefs regarding divine punishment for past transgressions, and concerns about the future. These factors exacerbate stress, leading to persistent tension or anxiety, which may culminate in depression. Furthermore, the restrictions imposed during the COVID-19 pandemic and the consequent behavioural changes in children have been observed to further impact caregivers' mental health.

The emotional well-being of caregivers is adversely affected by persistent concerns regarding recurrent illnesses and fluctuating behavioural patterns. Factors such as loss of appetite, irregular sleep patterns, limited recreational opportunities, and the child's disability hinder

caregivers' ability to maintain a positive outlook, leading to emotions such as sorrow, distress, fatigue, disinterest, impaired decision-making abilities, and diminished self-esteem and satisfaction.

Coexisting with a specially-abled child requires substantial strength and determination to confront significant challenges. Consequently, individuals with disabilities and their caregivers often exhibit reluctance to leave their homes, face difficulties in expressing their thoughts and opinions, encounter limited social interaction opportunities, experience physical exclusion, incur substantial medical expenses, lack access to rehabilitation services, endure bullying in educational settings, face barriers in voicing their concerns, and encounter obstacles in accessing public transportation, leading to experiences of mockery and discrimination. The lives of caregivers are characterised by uncertainty. The child's disability engenders a sense of isolation within the entire family, particularly for the primary caregiver.

Numerous mothers responsible for childcare report that their friends, family, and neighbours often fail to comprehend their experiences. The mothers frequently experience overwork due to the dual duties of childcare and household management. Mothers possessing higher levels of education and awareness of human rights are more inclined to seek support, articulate their concerns, and comprehend the needs of their child. Social exclusion is compounded by other forms of exclusion, such as institutional and physical barriers. Caregivers and the children face multiple challenges, including inadequate physical adaptability and accessibility, limited access to information and expertise, insufficient rehabilitation services, exorbitant medical costs, and discriminatory attitudes and behaviours. Institutions contribute to social exclusion through indifference, trickery, favouritism, and ineffective law enforcement. When interacting with institutions, individuals with disabilities often encounter avoidance, rejection, bullying, and harassment, which are frequently perceived as reflections of the caregivers' mental health.

When specially-abled children encounter stigma, significant consequences ensue. Such individuals are often subjected to differential treatment and are denied opportunities for education and training, employment, and other forms of support, as well as access to public health services and other essential services. This exclusion extends to their full participation in all societal aspects, including decision-making processes, due to stigma.

Discrimination rooted in stigma and the denial of fundamental rights adversely affects the specially-abled children as well as their families, on both social and economic levels. The stigma and the resultant feelings of value and illness render them more vulnerable to

psychological and physical abuse, including neglect, domestic and sexual abuse, and exploitation. The majority of prejudice and exclusion experienced by these individuals frequently originates from stigma. In the formulation of development policies, programs, and other initiatives, individuals with disabilities are often underserved. Therefore, the stigma they endure is inadequately addressed, perpetuating their marginalisation and adversely affecting their personal, societal, and economic well-being.

It is essential to educate the public about different types of impairments and appropriate ways to interact with people with disabilities. With the correct information, more people will be understanding and compassionate to those who have impairments, fostering a climate of respect.

**Conclusion**

The journey of a child with special needs is marked by considerable hurdles and difficulties from birth onward. At the heart of their support network are their caregivers, usually parents or other close individuals. These caregivers face a multitude of challenges, such as social isolation, stigma, depression, and anxiety, primarily due to the stress of their role and societal expectations related to caring for children with special needs. Ongoing worries about recurring health problems and unpredictable behaviour patterns negatively impact the caregivers' emotional health. Caring for children with special needs requires bravery and determination to overcome significant challenges. Both children with special needs and their caregivers often encounter exclusion and stigma from society. Different forms of exclusion, including institutional and physical, intersect with social exclusion. Institutions contribute to social exclusion through inaction, dishonesty, favouritism, and poor law enforcement. People with disabilities frequently experience avoidance, rejection, bullying, and harassment in their interactions with institutions, which are often seen as a reflection of the caregivers' mental health. Discrimination stemming from stigma and the denial of basic rights negatively impacts individuals with disabilities and often their families, both socially and economically. It is crucial to educate the public about various types of impairments and the appropriate ways to engage with individuals with disabilities. Campaigns and seminars can be used to promote this civic education. With accurate information, more people will develop empathy and understanding towards those with impairments, fostering a respectful environment.

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# पेडागोजी 4.0 और डिजिटल डिवाइड: तकनीक-आधारित शिक्षा में सामाजिक असमानता

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## सारांश

पेडागोजी 4.0 समकालीन शिक्षा की वह अवधारणा है जो कृत्रिम बुद्धिमत्ता, डिजिटल प्लेटफॉर्म, लर्निंग एनालिटिक्स, आभासी-वर्धित वास्तविकता तथा वैयक्तिकृत अधिगम जैसे नवाचारों के माध्यम से शिक्षण-अधिगम प्रक्रिया को अधिक लचीला, सहभागितापूर्ण और शिक्षार्थी-केंद्रित बनाती है। किंतु तकनीक-आधारित इस शैक्षिक परिवर्तन के साथ ही डिजिटल डिवाइड की समस्या और अधिक जटिल रूप में उभरकर सामने आई है। यह अध्ययन पेडागोजी 4.0 के परिप्रेक्ष्य में डिजिटल डिवाइड को सामाजिक असमानता के एक प्रमुख कारक के रूप में विश्लेषित करता है। शोध में यह तर्क प्रस्तुत किया गया है कि डिजिटल संसाधनों तक असमान पहुँच, इंटरनेट कनेक्टिविटी की कमी, उपकरणों की अनुपलब्धता तथा डिजिटल साक्षरता का अभाव विशेषकर ग्रामीण, आर्थिक रूप से कमजोर, आदिवासी और हाशिए पर स्थित समुदायों के लिए तकनीक-आधारित शिक्षा के लाभों को सीमित कर देता है। परिणामस्वरूप, शिक्षा में अवसरों की समानता के स्थान पर नई प्रकार की शैक्षिक असमानताएँ उत्पन्न हो रही हैं। अध्ययन यह भी रेखांकित करता है कि यदि पेडागोजी 4.0 को समावेशी दृष्टिकोण के साथ लागू नहीं किया गया, तो यह सामाजिक सशक्तिकरण के बजाय डिजिटल बहिष्करण को बढ़ावा दे सकती है। निष्कर्षतः, शोध यह सुझाव देता है कि डिजिटल अवसंरचना का विस्तार, डिजिटल साक्षरता कार्यक्रम, सस्ती तकनीकी उपलब्धता तथा संवेदनशील शैक्षिक नीतियाँ अपनाकर ही पेडागोजी 4.0 को सामाजिक न्याय और समावेशी शिक्षा के प्रभावी माध्यम के रूप में विकसित किया जा सकता है।

**बीज शब्द:** पेडागोजी 4.0, डिजिटल डिवाइड, तकनीक-आधारित शिक्षा, सामाजिक असमानता।

## 1.प्रस्तावना

इक्कीसवीं सदी में शिक्षा व्यवस्था तीव्र तकनीकी परिवर्तनों के दौर से गुजर रही है। चौथी औद्योगिक क्रांति जिसका आधार कृत्रिम बुद्धिमत्ता, मशीन लर्निंग, बिग डेटा, इंटरनेट ऑफ थिंग्स, क्लाउड कंप्यूटिंग और स्वचालन है—इसने न केवल उत्पादन और अर्थव्यवस्था के स्वरूप को बदला है, बल्कि शिक्षा के उद्देश्यों, प्रक्रियाओं और संरचनाओं को भी पुनर्परिभाषित किया है। परंपरागत शिक्षक-केंद्रित और पाठ्यपुस्तक-आधारित शिक्षा अब डिजिटल प्लेटफॉर्म, आभासी कक्षाओं और तकनीक-समर्थित अधिगम की ओर अग्रसर हो रही है। इस परिवर्तन ने सीखने को अधिक लचीला, वैयक्तिकृत और वैश्विक बनाया है, किंतु इसके साथ ही नई प्रकार की असमानताओं को भी जन्म दिया है। इसी संदर्भ में पेडागोजी 4.0 एक समकालीन शिक्षण-अधिगम अवधारणा के रूप में उभरकर सामने आती है। पेडागोजी 4.0 का उद्भव उद्योग 4.0 की आवश्यकताओं के अनुरूप शिक्षा को ढालने के प्रयास के रूप में हुआ है, जिसमें शिक्षार्थी-केंद्रितता, डिजिटल साक्षरता, नवाचार, समस्या-समाधान, आलोचनात्मक चिंतन तथा आजीवन अधिगम पर विशेष बल दिया जाता है। यह अवधारणा कृत्रिम बुद्धिमत्ता-आधारित शिक्षण, लर्निंग

एनालिटिक्स, ऑनलाइन प्लेटफॉर्म, आभासी एवं संवर्धित वास्तविकता तथा वैयक्तिकृत अधिगम मार्गों के माध्यम से शिक्षा को अधिक प्रभावी और प्रासंगिक बनाने का दावा करती है। परिणामस्वरूप शिक्षक की भूमिका ज्ञान के प्रदाता से मार्गदर्शक और सह-अधिगमकर्ता की ओर परिवर्तित हो रही है।

हालाँकि, तकनीक-आधारित इस शैक्षिक परिवर्तन के समानांतर डिजिटल डिवाइड की समस्या भी गंभीर रूप लेती जा रही है। डिजिटल डिवाइड से आशय समाज के विभिन्न वर्गों के बीच तकनीकी संसाधनों की उपलब्धता, डिजिटल कौशल और गुणवत्तापूर्ण ऑनलाइन शिक्षा तक पहुँच में विद्यमान अंतर से है। यह विभाजन शहरी-ग्रामीण, आर्थिक, सामाजिक, लैंगिक तथा भाषायी स्तरों पर स्पष्ट रूप से परिलक्षित होता है। जिन वर्गों के पास इंटरनेट, डिजिटल उपकरण और तकनीकी दक्षता का अभाव है, वे पेडागोजी 4.0 के लाभों से वंचित रह जाते हैं, जिससे शिक्षा में सामाजिक असमानता और अधिक गहरी हो जाती है। ऐसी स्थिति में इस शोध की समस्या यह है कि पेडागोजी 4.0 द्वारा प्रस्तुत तकनीक-आधारित शैक्षिक मॉडल क्या वास्तव में समावेशी शिक्षा को बढ़ावा दे पा रहा है, या यह डिजिटल डिवाइड के कारण सामाजिक असमानताओं को और सुदृढ़ कर रहा है। अध्ययन की आवश्यकता इस तथ्य से उत्पन्न होती है कि तकनीक को शिक्षा का सशक्त माध्यम तभी बनाया जा सकता है जब उसकी पहुँच समान और न्यायसंगत हो। अतः यह शोध पेडागोजी 4.0 और डिजिटल डिवाइड के पारस्परिक संबंध का विश्लेषण करते हुए यह समझने का प्रयास करता है कि तकनीक-आधारित शिक्षा को सामाजिक न्याय, समावेशन और समान अवसर के साधन के रूप में कैसे विकसित किया जा सकता है।

## 2. पेडागोजी 4.0: अवधारणा और विशेषताएँ

### 2.1 पेडागोजी 4.0 की परिभाषा

पेडागोजी 4.0 शिक्षा की वह समकालीन अवधारणा है जो चौथी औद्योगिक क्रांति की आवश्यकताओं के अनुरूप शिक्षण-अधिगम प्रक्रियाओं को पुनर्गठित करती है। यह परंपरागत स्मृति-आधारित और शिक्षक-केंद्रित शिक्षा के स्थान पर शिक्षार्थी-केंद्रित, तकनीक-समर्थित, नवाचार-उन्मुख और कौशल-आधारित अधिगम पर बल देती है। पेडागोजी 4.0 में डिजिटल तकनीकों का उपयोग केवल सहायक साधन के रूप में नहीं, बल्कि सीखने की संरचना, सामग्री, मूल्यांकन और अनुभव को रूपांतरित करने वाले केंद्रीय तत्व के रूप में किया जाता है। इसका उद्देश्य शिक्षार्थियों को जटिल समस्याओं के समाधान, आलोचनात्मक चिंतन, रचनात्मकता और आजीवन अधिगम के लिए सक्षम बनाना है।

### 2.2 पेडागोजी 4.0 के प्रमुख घटक

*(क) कृत्रिम बुद्धिमत्ता:* यह पेडागोजी 4.0 का एक प्रमुख आधार स्तंभ है। एआइ-आधारित सिस्टम शिक्षार्थियों की सीखने की गति, रुचि और क्षमता का विश्लेषण कर अनुकूली अधिगम को संभव बनाते हैं। इंटेलिजेंट ट्यूटरिंग सिस्टम, चैटबॉट्स और स्वचालित मूल्यांकन तकनीकें शिक्षण को अधिक प्रभावी और समयोचित बनाती हैं। इससे शिक्षक को व्यक्तिगत मार्गदर्शन हेतु अधिक अवसर प्राप्त होते हैं।

*(ख) लर्निंग एनालिटिक्स:* लर्निंग एनालिटिक्स शिक्षार्थियों के डेटा—जैसे उपस्थिति, प्रदर्शन, सहभागिता और सीखने के पैटर्न—का विश्लेषण कर शिक्षण-अधिगम की गुणवत्ता में सुधार करने में सहायक होता है। इसके माध्यम से शिक्षकों को यह समझने

में सहायता मिलती है कि कौन-से विद्यार्थी सीखने में पिछड़ रहे हैं और किन क्षेत्रों में हस्तक्षेप की आवश्यकता है। इस प्रकार यह डेटा-आधारित निर्णय-निर्माण को बढ़ावा देता है।

*(ग) डिजिटल प्लेटफॉर्म और मूक्स:* डिजिटल प्लेटफॉर्म तथा मूक्स ने शिक्षा की भौगोलिक और संस्थागत सीमाओं को कम किया है। ऑनलाइन पाठ्यक्रम, वीडियो व्याख्यान, इंटरैक्टिव मॉड्यूल और ओपन एजुकेशनल रिसोर्सेज के माध्यम से शिक्षार्थी अपनी सुविधा के अनुसार सीख सकते हैं। पेडागोजी 4.0 में ये प्लेटफॉर्म शिक्षा के लोकतंत्रीकरण का माध्यम माने जाते हैं, हालांकि इनकी पहुँच डिजिटल संसाधनों पर निर्भर करती है।

*(घ) आभासी एवं संवर्धित वास्तविकता:* वीआर और एआर तकनीकें सीखने को अनुभवात्मक बनाती हैं। इनके माध्यम से जटिल अवधारणाओं को दृश्य और व्यवहारिक रूप में समझना सरल हो जाता है। विज्ञान, चिकित्सा, इंजीनियरिंग और इतिहास जैसे विषयों में यह तकनीकें वास्तविक परिस्थितियों का अनुकरण कर शिक्षार्थियों की सहभागिता और समझ को गहरा करती हैं।

*(ङ) वैयक्तिकृत अधिगम:* पेडागोजी 4.0 का केंद्रीय उद्देश्य "एक-सा पाठ्यक्रम सभी के लिए" की धारणा से आगे बढ़कर प्रत्येक शिक्षार्थी की आवश्यकता, क्षमता और रुचि के अनुरूप अधिगम मार्ग विकसित करना है। वैयक्तिकृत अधिगम शिक्षार्थियों को अपनी गति से सीखने, विषय चयन करने और आत्म-मूल्यांकन का अवसर प्रदान करता है, जिससे अधिगम अधिक सार्थक और स्थायी बनता है।

## 2.3 शिक्षक और शिक्षार्थी की बदलती भूमिका

पेडागोजी 4.0 में शिक्षक की भूमिका पारंपरिक ज्ञान-प्रदाता से बदलकर मार्गदर्शक, प्रेरक और अधिगम-सुविधाकर्ता की हो जाती है। शिक्षक अब सीखने के अनुभव को डिजाइन करने, डिजिटल संसाधनों के प्रभावी उपयोग और आलोचनात्मक चिंतन को प्रोत्साहित करने पर ध्यान केंद्रित करते हैं। वहीं, शिक्षार्थी निष्क्रिय श्रोता न रहकर सक्रिय सहभागी, स्व-निर्देशित और उत्तरदायी अधिगमकर्ता बनता है। वह ज्ञान का सह-निर्माता होता है, जो सहयोग, संवाद और तकनीकी साधनों के माध्यम से अपने सीखने की प्रक्रिया को स्वयं नियंत्रित करता है।

## 3. डिजिटल डिवाइड: अर्थ और आयाम

## 3.1 डिजिटल डिवाइड की परिभाषा

डिजिटल डिवाइड से आशय समाज के विभिन्न वर्गों के बीच सूचना एवं संचार प्रौद्योगिकी तक पहुँच, उसके उपयोग की क्षमता तथा उससे प्राप्त होने वाले लाभों में विद्यमान असमानता से है। यह केवल इंटरनेट या डिजिटल उपकरणों की अनुपलब्धता तक सीमित नहीं है, बल्कि डिजिटल कौशल, भाषा, सामग्री की गुणवत्ता और तकनीक के सार्थक उपयोग से भी गहराई से जुड़ा हुआ है। तकनीक-आधारित शिक्षा के संदर्भ में डिजिटल डिवाइड उन बाधाओं को इंगित करता है जो शिक्षार्थियों को पेडागोजी 4.0 के अवसरों से समान रूप से लाभान्वित होने से रोकती हैं।

## 3.2 डिजिटल डिवाइड के प्रमुख आयाम

*(क) प्रवेश विभाजन: उपकरण और इंटरनेट की उपलब्धता*

प्रवेश विभाजन डिजिटल डिवाइड का सबसे प्रत्यक्ष और प्रारंभिक रूप है। इसका संबंध स्मार्टफोन, कंप्यूटर, टैबलेट, इंटरनेट कनेक्टिविटी और बिजली जैसी बुनियादी सुविधाओं की उपलब्धता से है। आर्थिक रूप से कमजोर वर्ग, ग्रामीण क्षेत्र और दूरदराज़ के इलाकों में रहने वाले शिक्षार्थी अक्सर इन संसाधनों से वंचित रहते हैं। परिणामस्वरूप वे ऑनलाइन कक्षाओं, डिजिटल सामग्री और तकनीक-आधारित मूल्यांकन प्रणालियों में समान रूप से भाग नहीं ले पाते, जिससे शैक्षिक असमानता और गहरी हो जाती है।

*(ख) उपयोग विभाजन: डिजिटल साक्षरता और कौशल*

केवल डिजिटल उपकरणों की उपलब्धता ही पर्याप्त नहीं है; उनका प्रभावी उपयोग भी आवश्यक है। उपयोग विभाजन डिजिटल साक्षरता, तकनीकी कौशल और आत्मविश्वास के अंतर को दर्शाता है। अनेक शिक्षार्थी और शिक्षक डिजिटल प्लेटफॉर्म, लर्निंग मैनेजमेंट सिस्टम और ऑनलाइन टूल्स के उपयोग में दक्ष नहीं होते। यह स्थिति विशेषकर प्रथम-पीढ़ी के शिक्षार्थियों, ग्रामीण समुदायों और वरिष्ठ शिक्षकों में अधिक देखने को मिलती है, जिससे तकनीक-आधारित शिक्षा की प्रभावशीलता सीमित हो जाती है।

*(ग) गुणवत्ता विभाजन: सामग्री और प्लेटफॉर्म की गुणवत्ता*

गुणवत्ता विभाजन डिजिटल डिवाइड का एक सूक्ष्म किंतु महत्वपूर्ण आयाम है। इसका संबंध उपलब्ध डिजिटल सामग्री की गुणवत्ता, भाषा, प्रासंगिकता, इंटरैक्टिवता और प्लेटफॉर्म की शैक्षिक विश्वसनीयता से है। निजी और महंगे डिजिटल प्लेटफॉर्म प्रायः बेहतर सामग्री और तकनीकी समर्थन प्रदान करते हैं, जबकि सरकारी या निःशुल्क संसाधनों की गुणवत्ता कई बार सीमित होती है। इससे शिक्षार्थियों के बीच सीखने के अनुभव और परिणामों में अंतर उत्पन्न होता है।

## 3.3 डिजिटल डिवाइड के सामाजिक रूप

*(क) शहरी–ग्रामीण विभाजन:* शहरी क्षेत्रों में बेहतर इंटरनेट कनेक्टिविटी, डिजिटल इंफ्रास्ट्रक्चर और तकनीकी जागरूकता उपलब्ध होती है, जबकि ग्रामीण क्षेत्रों में नेटवर्क की कमजोरी, उपकरणों की कमी और तकनीकी प्रशिक्षण का अभाव स्पष्ट रूप से देखा जाता है। यह शहरी-ग्रामीण अंतर तकनीक-आधारित शिक्षा में असमान अवसरों को जन्म देता है।

*(ख) अमीर–गरीब विभाजन:* आर्थिक स्थिति डिजिटल संसाधनों की उपलब्धता का एक निर्णायक कारक है। संपन्न वर्ग के शिक्षार्थी उन्नत उपकरण, तेज़ इंटरनेट और सशुल्क डिजिटल प्लेटफॉर्म का उपयोग कर पाते हैं, जबकि गरीब वर्ग बुनियादी संसाधनों के अभाव में पीछे रह जाता है। इससे शिक्षा में डिजिटल बहिष्करण की स्थिति उत्पन्न होती है।

*(ग) लैंगिक विभाजन:* डिजिटल डिवाइड का एक महत्वपूर्ण सामाजिक आयाम लैंगिक असमानता भी है। कई समाजों में लड़कियों और महिलाओं की डिजिटल उपकरणों तक पहुँच, इंटरनेट उपयोग और तकनीकी प्रशिक्षण सीमित रहता है। यह स्थिति उनकी शैक्षिक प्रगति, डिजिटल कौशल विकास और भविष्य के अवसरों को बाधित करती है।

## 3.4 पेडागोजी 4.0 के संदर्भ में डिजिटल डिवाइड का महत्व

पेडागोजी 4.0 की सफलता इस बात पर निर्भर करती है कि डिजिटल डिवाइड को किस हद तक कम किया जा सकता है। यदि प्रवेश, उपयोग और गुणवत्ता के स्तर पर असमानताएँ बनी रहती हैं, तो तकनीक-आधारित शिक्षा समावेशन के बजाय सामाजिक

विभाजन को और बढ़ा सकती है। अतः डिजिटल डिवाइड का बहुआयामी विश्लेषण पेडागोजी 4.0 की सामाजिक प्रासंगिकता को समझने के लिए अनिवार्य है।

## 4. तकनीक-आधारित शिक्षा और सामाजिक असमानता

### 4.1 तकनीक के कारण उत्पन्न नई शैक्षिक असमानताएँ

तकनीक-आधारित शिक्षा को प्रायः समान अवसर उपलब्ध कराने वाले माध्यम के रूप में देखा जाता है, किंतु व्यवहार में यह कई नई प्रकार की शैक्षिक असमानताओं को भी जन्म देती है। डिजिटल प्लेटफॉर्म, ऑनलाइन मूल्यांकन, एआई-आधारित अधिगम और वर्चुअल कक्षाएँ उन्हीं शिक्षार्थियों के लिए अधिक लाभकारी सिद्ध होती हैं जिनके पास पर्याप्त संसाधन, तकनीकी कौशल और अनुकूल अधिगम वातावरण उपलब्ध है। इसके विपरीत, जिन शिक्षार्थियों के पास उपकरण, इंटरनेट या डिजिटल साक्षरता का अभाव है, वे तकनीक-आधारित शिक्षा से धीरे-धीरे बाहर होते चले जाते हैं। इस प्रकार तकनीक पारंपरिक असमानताओं को कम करने के बजाय कई बार उन्हें और गहरा कर देती है।

### 4.2 वंचित वर्गों पर तकनीक-आधारित शिक्षा का प्रभाव

*(क) अनुसूचित जाति/अनुसूचित जनजाति:* इन समुदायों के अनेक शिक्षार्थी आर्थिक, सामाजिक और भौगोलिक सीमाओं के कारण डिजिटल संसाधनों तक पर्याप्त पहुँच नहीं बना पाते। ऑनलाइन शिक्षा में भागीदारी के लिए आवश्यक उपकरण, स्थिर इंटरनेट और शांत अध्ययन वातावरण का अभाव उनके शैक्षिक अनुभव को बाधित करता है। परिणामस्वरूप तकनीक-आधारित शिक्षा उनके लिए सशक्तिकरण के बजाय बहिष्करण का कारण बन सकती है।

*(ख) ग्रामीण शिक्षार्थी:* ग्रामीण क्षेत्रों में नेटवर्क की अस्थिरता, बिजली की समस्या और तकनीकी प्रशिक्षण का अभाव तकनीक-आधारित शिक्षा की प्रभावशीलता को सीमित करता है। शहरी शिक्षार्थियों की तुलना में ग्रामीण विद्यार्थी डिजिटल प्लेटफॉर्म का पूर्ण उपयोग नहीं कर पाते, जिससे शहरी-ग्रामीण शैक्षिक अंतर और अधिक बढ़ जाता है।

*(ग) दिव्यांग शिक्षार्थी:* यद्यपि तकनीक में दिव्यांग शिक्षार्थियों के लिए समावेशी संभावनाएँ निहित हैं, परंतु अधिकांश डिजिटल प्लेटफॉर्म और सामग्री सुलभता के मानकों पर खरे नहीं उतरते। स्क्रीन-रीडर समर्थन, सांकेतिक भाषा, उपशीर्षक और अनुकूल इंटरफेस के अभाव में दिव्यांग शिक्षार्थी तकनीक-आधारित शिक्षा से पूर्ण लाभ नहीं उठा पाते।

*(घ) अल्पसंख्यक समुदाय:* भाषायी, सांस्कृतिक और आर्थिक कारणों से अल्पसंख्यक समुदायों के शिक्षार्थियों की डिजिटल सहभागिता सीमित रहती है। ऑनलाइन शिक्षा में मुख्यतः बहुसंख्यक भाषा और संस्कृति पर आधारित सामग्री का प्रभुत्व उनके सीखने के अनुभव को प्रभावित करता है।

### 4.3 भाषा, संस्कृति और सामाजिक पूंजी का प्रभाव

तकनीक-आधारित शिक्षा में भाषा एक महत्वपूर्ण निर्धारक तत्व है। अधिकांश डिजिटल सामग्री और मूक्स अंग्रेजी या प्रमुख भाषाओं में उपलब्ध होती हैं, जिससे मातृभाषा या क्षेत्रीय भाषा के शिक्षार्थी पीछे रह जाते हैं।

साथ ही, संस्कृति और सामाजिक पूंजी—जैसे परिवार का शैक्षिक वातावरण, अभिभावकों की तकनीकी समझ और सामाजिक नेटवर्क—भी डिजिटल शिक्षा में सफलता को प्रभावित करते हैं। जिन शिक्षार्थियों के पास मजबूत सामाजिक पूंजी होती है, वे तकनीक का बेहतर उपयोग कर पाते हैं, जबकि वंचित पृष्ठभूमि के विद्यार्थी डिजिटल तंत्र में हाशिए पर चले जाते हैं।

## 4.4 निजी और सरकारी शिक्षा संस्थानों के बीच अंतर

तकनीक-आधारित शिक्षा ने निजी और सरकारी संस्थानों के बीच की खाई को और स्पष्ट कर दिया है। निजी संस्थान उन्नत डिजिटल इंफ्रास्ट्रक्चर, सशुल्क प्लेटफॉर्म, प्रशिक्षित शिक्षक और नवीन तकनीकों का उपयोग कर पाते हैं। इसके विपरीत, अनेक सरकारी विद्यालय और महाविद्यालय बुनियादी डिजिटल सुविधाओं, प्रशिक्षण और तकनीकी समर्थन के अभाव से जूझ रहे हैं। इससे सरकारी संस्थानों में पढ़ने वाले शिक्षार्थियों की तकनीक-आधारित अधिगम क्षमता सीमित हो जाती है और शैक्षिक असमानता संस्थागत स्तर पर पुनरुत्पादित होती है।

स्पष्ट है कि तकनीक-आधारित शिक्षा अपने वर्तमान स्वरूप में सामाजिक असमानताओं को पूरी तरह समाप्त नहीं कर पाई है। जब तक डिजिटल संसाधनों की समान उपलब्धता, सुलभ सामग्री और समावेशी नीतियाँ सुनिश्चित नहीं की जातीं, तब तक पेडागोजी 4.0 सामाजिक न्याय के लक्ष्य को प्राप्त नहीं कर सकती। अतः तकनीक को समानता का उपकरण बनाने के लिए संरचनात्मक और नीतिगत हस्तक्षेप अनिवार्य हैं।

## 5. भारतीय संदर्भ में पेडागोजी 4.0 और डिजिटल डिवाइड

### 5.1 भारत में डिजिटल शिक्षा की वर्तमान स्थिति

भारत में डिजिटल शिक्षा का विस्तार हाल के वर्षों में तीव्र गति से हुआ है। स्मार्टफोन और इंटरनेट के बढ़ते प्रसार, ई-लर्निंग प्लेटफॉर्म्स, ऑनलाइन पाठ्यक्रमों और शैक्षिक ऐप्स ने शिक्षा के स्वरूप को व्यापक रूप से प्रभावित किया है। पेडागोजी 4.0 के अंतर्गत डिजिटल उपकरणों, एआई-आधारित शिक्षण, ऑनलाइन मूल्यांकन और मिश्रित अधिगम को अपनाने की प्रवृत्ति बढ़ी है। हालाँकि, यह प्रगति समान रूप से वितरित नहीं है। शहरी क्षेत्रों, निजी संस्थानों और संपन्न वर्गों में डिजिटल शिक्षा की पहुँच अपेक्षाकृत बेहतर है, जबकि ग्रामीण क्षेत्रों, सरकारी संस्थानों और वंचित समुदायों में डिजिटल संसाधनों की कमी स्पष्ट रूप से दिखाई देती है। इस असमान वितरण के कारण डिजिटल डिवाइड भारतीय शिक्षा व्यवस्था की एक गंभीर चुनौती बना हुआ है।

### 5.2 कोविड-19 के बाद ऑनलाइन शिक्षा का अनुभव

कोविड-19 महामारी ने भारत में डिजिटल शिक्षा को अचानक अनिवार्य बना दिया। विद्यालयों और विश्वविद्यालयों के बंद होने के कारण ऑनलाइन कक्षाएँ, वीडियो लेक्चर और डिजिटल असाइनमेंट ही शिक्षा का प्रमुख माध्यम बन गए। इस अवधि में पेडागोजी 4.0 के कई तत्व—जैसे वर्चुअल क्लासरूम, लर्निंग मैनेजमेंट सिस्टम और डिजिटल मूल्यांकन—व्यापक रूप से अपनाए गए। किन्तु महामारी ने डिजिटल डिवाइड की वास्तविकता को भी उजागर किया। लाखों शिक्षार्थी इंटरनेट, उपकरण और अनुकूल अध्ययन वातावरण के अभाव में शिक्षा से आंशिक या पूर्ण रूप से वंचित रह गए। विशेषकर ग्रामीण, गरीब और प्रथम-पीढ़ी के शिक्षार्थियों के लिए ऑनलाइन शिक्षा एक गंभीर चुनौती सिद्ध हुई। इस अनुभव ने यह स्पष्ट किया कि तकनीक-आधारित शिक्षा बिना समावेशी संरचना के सामाजिक असमानताओं को और बढ़ा सकती है।

### 5.3 डिजिटल इंडिया, स्वयं और दीक्षा जैसी पहलें

भारत सरकार ने डिजिटल शिक्षा को बढ़ावा देने हेतु कई महत्त्वपूर्ण पहलें आरंभ की हैं। डिजिटल इंडिया कार्यक्रम का उद्देश्य डिजिटल इंफ्रास्ट्रक्चर का विस्तार, डिजिटल साक्षरता और ऑनलाइन सेवाओं की पहुँच को सुनिश्चित करना है। इसी क्रम में स्वयं प्लेटफॉर्म के माध्यम से उच्च गुणवत्ता वाले ऑनलाइन पाठ्यक्रम निःशुल्क उपलब्ध कराए जा रहे हैं, जिससे उच्च शिक्षा में पेडागोजी 4.0 को प्रोत्साहन मिला है। दीक्षा प्लेटफॉर्म शिक्षकों और विद्यार्थियों के लिए डिजिटल सामग्री, प्रशिक्षण मॉड्यूल और संसाधन उपलब्ध कराता है। इन पहलों ने तकनीक-आधारित शिक्षा को संस्थागत स्वरूप प्रदान किया है, किंतु इनका लाभ भी मुख्यतः उन्हीं तक सीमित है जिनके पास डिजिटल पहुँच और कौशल उपलब्ध है।

### 5.4 जमीनी स्तर पर क्रियान्वयन की चुनौतियाँ

यद्यपि नीतिगत स्तर पर डिजिटल शिक्षा को बढ़ावा दिया जा रहा है, परंतु जमीनी स्तर पर इसके क्रियान्वयन में अनेक चुनौतियाँ विद्यमान हैं। इनमें प्रमुख हैं—
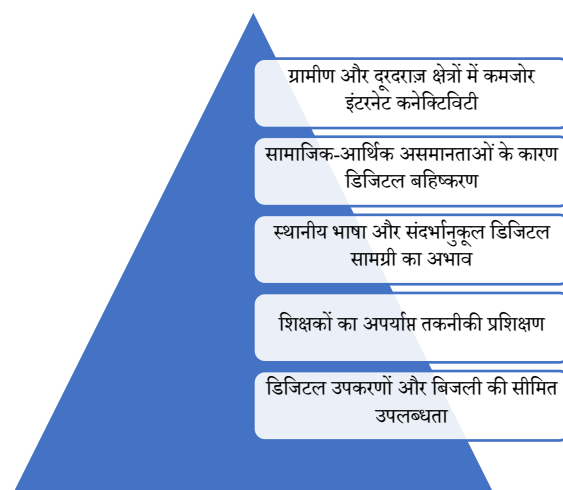


चित्र 1. जमीनी स्तर पर क्रियान्वयन की चुनौतियाँ

इन चुनौतियों के कारण पेडागोजी 4.0 का प्रभाव अपेक्षित स्तर तक नहीं पहुँच पा रहा है और डिजिटल डिवाइड भारतीय शिक्षा प्रणाली में एक संरचनात्मक समस्या के रूप में बना हुआ है।

भारतीय संदर्भ में पेडागोजी 4.0 अपार संभावनाएँ रखती है, किंतु डिजिटल डिवाइड इसके समावेशी क्रियान्वयन में सबसे बड़ी बाधा है। जब तक डिजिटल इंफ्रास्ट्रक्चर, प्रशिक्षण और संसाधनों का समान वितरण सुनिश्चित नहीं किया जाता, तब तक तकनीक-आधारित शिक्षा सामाजिक समानता का साधन बनने के बजाय असमानताओं को पुनरुत्पादित करती रहेगी

### 6. अवसर बनाम चुनौतियाँ

पेडागोजी 4.0 और तकनीक-आधारित शिक्षा एक ओर शिक्षा व्यवस्था को रूपांतरित करने के महत्त्वपूर्ण अवसर प्रदान करती है, तो दूसरी ओर यह अनेक संरचनात्मक, सामाजिक और नैतिक चुनौतियाँ भी उत्पन्न करती है। इन दोनों पक्षों का संतुलित विश्लेषण पेडागोजी 4.0 की वास्तविक क्षमता को समझने के लिए आवश्यक है।

## 6.1 अवसर

*(क) शिक्षा का लोकतंत्रीकरण:* तकनीक-आधारित शिक्षा ने ज्ञान की पहुँच को व्यापक बनाया है। डिजिटल प्लेटफॉर्म, मूक्स और ओपन एजुकेशनल रिसोर्सेज के माध्यम से शिक्षा अब केवल चुनिंदा संस्थानों या वर्गों तक सीमित नहीं रही। भौगोलिक सीमाओं को पार करते हुए शिक्षार्थी गुणवत्तापूर्ण शैक्षिक सामग्री तक पहुँच बना सकते हैं। इस प्रकार पेडागोजी 4.0 शिक्षा के लोकतंत्रीकरण की दिशा में एक सशक्त माध्यम बनती है।

*(ख) आजीवन अधिगम:* पेडागोजी 4.0 औपचारिक शिक्षा से आगे बढ़कर आजीवन अधिगम की अवधारणा को सुदृढ़ करती है। ऑनलाइन पाठ्यक्रम, माइक्रो-क्रेडेंशियल्स और स्व-अधिगम प्लेटफॉर्म व्यक्तियों को अपने जीवन के विभिन्न चरणों में नए कौशल और ज्ञान अर्जित करने का अवसर प्रदान करते हैं। यह बदलते श्रम-बाज़ार और तकनीकी परिवेश में निरंतर सीखने की आवश्यकता को पूरा करता है।

*(ग) नवाचार और कौशल-आधारित शिक्षा:* तकनीक-आधारित शिक्षा नवाचार, रचनात्मकता और कौशल-आधारित अधिगम को प्रोत्साहित करती है। परियोजना-आधारित सीखना, समस्या-समाधान, सहयोगात्मक अधिगम और डिजिटल टूल्स के उपयोग से शिक्षार्थियों में 21वीं सदी के आवश्यक कौशल—जैसे आलोचनात्मक चिंतन, संचार और डिजिटल दक्षता— विकसित होते हैं। इससे शिक्षा और रोजगार के बीच की दूरी कम करने में सहायता मिलती है।

## 6.2 चुनौतियाँ

*(क) तकनीकी संसाधनों की असमान उपलब्धता:* पेडागोजी 4.0 की सबसे बड़ी चुनौती तकनीकी संसाधनों की असमान उपलब्धता है। इंटरनेट, डिजिटल उपकरण और बिजली जैसी बुनियादी सुविधाओं की कमी के कारण बड़ी संख्या में शिक्षार्थी तकनीक-आधारित शिक्षा से वंचित रह जाते हैं। यह असमानता शहरी-ग्रामीण, अमीर-गरीब और सामाजिक वर्गों के बीच स्पष्ट रूप से दिखाई देती है।

*(ख) शिक्षकों का प्रशिक्षण:* पेडागोजी 4.0 के प्रभावी क्रियान्वयन के लिए शिक्षकों का डिजिटल रूप से सक्षम होना अनिवार्य है। किंतु अनेक शिक्षक नई तकनीकों, डिजिटल प्लेटफॉर्म और ऑनलाइन शिक्षण-विधियों के उपयोग में प्रशिक्षित नहीं हैं। क्षमता-निर्माण और सतत प्रशिक्षण के अभाव में तकनीक शिक्षा का साधन बनने के बजाय एक अतिरिक्त बोझ बन सकती है।

*(ग) डेटा गोपनीयता और नैतिकता:* डिजिटल शिक्षा में शिक्षार्थियों का डेटा—जैसे शैक्षणिक प्रदर्शन, व्यवहार और व्यक्तिगत जानकारी—व्यापक रूप से संग्रहित और विश्लेषित किया जाता है। इससे डेटा गोपनीयता, साइबर सुरक्षा और नैतिकता से जुड़े गंभीर प्रश्न उत्पन्न होते हैं। यदि उपयुक्त कानूनी और नैतिक ढाँचे विकसित नहीं किए गए, तो तकनीक-आधारित शिक्षा शिक्षार्थियों के अधिकारों के लिए खतरा बन सकती है।

*(घ) डिजिटल बहिष्करण:* तकनीक-आधारित शिक्षा का सबसे गंभीर दुष्परिणाम डिजिटल बहिष्करण है। जो शिक्षार्थी तकनीकी, भाषायी या सामाजिक कारणों से डिजिटल प्लेटफॉर्म से नहीं जुड़ पाते, वे शिक्षा की मुख्यधारा से बाहर हो जाते हैं। इस प्रकार तकनीक समानता का माध्यम बनने के बजाय सामाजिक बहिष्करण को और सुदृढ़ कर सकती है।

स्पष्ट है कि पेडागोजी 4.0 शिक्षा के क्षेत्र में क्रांतिकारी परिवर्तन की क्षमता रखती है, किंतु इसके अवसर तभी सार्थक सिद्ध होंगे जब उससे जुड़ी चुनौतियों का समाधान समावेशी और न्यायपूर्ण दृष्टिकोण से किया जाए। अन्यथा, तकनीक-आधारित शिक्षा सामाजिक समानता के बजाय असमानता को पुनरुत्पादित करने का माध्यम बन सकती है

## 7. समावेशी पेडागोजी 4.0 के लिए रणनीतियाँ

पेडागोजी 4.0 को सामाजिक न्याय और शैक्षिक समानता का माध्यम बनाने के लिए यह आवश्यक है कि तकनीक-आधारित शिक्षा को समावेशी दृष्टिकोण के साथ लागू किया जाए। इसके लिए बहु-स्तरीय और समन्वित रणनीतियों की आवश्यकता है, जो डिजिटल डिवाइड को कम करते हुए सभी शिक्षार्थियों को समान अवसर प्रदान कर सकें।

### 7.1 डिजिटल इन्फ्रास्ट्रक्चर का विस्तार

समावेशी पेडागोजी 4.0 की आधारशिला मजबूत और समान डिजिटल इन्फ्रास्ट्रक्चर है। इसके अंतर्गत ग्रामीण और दूरदराज़ क्षेत्रों में उच्च-गति इंटरनेट कनेक्टिविटी, विश्वसनीय बिजली आपूर्ति और किफायती डिजिटल उपकरणों की उपलब्धता सुनिश्चित करना आवश्यक है। विद्यालयों और महाविद्यालयों में स्मार्ट कक्षाओं, डिजिटल लैब और सामुदायिक डिजिटल केंद्रों की स्थापना से तकनीक-आधारित शिक्षा की पहुँच को व्यापक बनाया जा सकता है। डिजिटल इन्फ्रास्ट्रक्चर का विस्तार केवल तकनीकी नहीं, बल्कि सामाजिक समावेशन की दिशा में एक निर्णायक कदम है।

### 7.2 स्थानीय भाषा आधारित डिजिटल सामग्री

डिजिटल शिक्षा में भाषायी समावेशन एक महत्वपूर्ण रणनीति है। अधिकांश ऑनलाइन सामग्री और प्लेटफॉर्म अंग्रेज़ी-केंद्रित होने के कारण बड़ी संख्या में शिक्षार्थियों के लिए बाधक सिद्ध होते हैं। अतः स्थानीय और क्षेत्रीय भाषाओं में गुणवत्तापूर्ण डिजिटल सामग्री, ई-पाठ्यपुस्तकें, वीडियो व्याख्यान और इंटरैक्टिव मॉड्यूल विकसित करना आवश्यक है। मातृभाषा-आधारित डिजिटल अधिगम न केवल समझ को सुदृढ़ करता है, बल्कि शिक्षार्थियों की सहभागिता और आत्मविश्वास को भी बढ़ाता है।

### 7.3 शिक्षक प्रशिक्षण और क्षमता निर्माण

पेडागोजी 4.0 की सफलता शिक्षकों की डिजिटल और पेडागोजिकल दक्षता पर निर्भर करती है। इसलिए शिक्षकों के लिए निरंतर प्रशिक्षण, कार्यशालाएँ और प्रमाणन कार्यक्रम अनिवार्य हैं, जिनमें डिजिटल टूल्स का उपयोग, ऑनलाइन शिक्षण-विधियाँ, डेटा-आधारित मूल्यांकन और समावेशी शिक्षा के सिद्धांत शामिल हों। शिक्षक को केवल तकनीक का उपयोगकर्ता नहीं, बल्कि डिजिटल अधिगम का डिज़ाइनर बनाना इस रणनीति का प्रमुख उद्देश्य होना चाहिए।

### 7.4 सार्वजनिक–निजी भागीदारी

समावेशी पेडागोजी 4.0 के प्रभावी क्रियान्वयन के लिए सार्वजनिक–निजी भागीदारी एक महत्वपूर्ण रणनीति के रूप में उभरती है। निजी क्षेत्र की तकनीकी विशेषज्ञता, नवाचार क्षमता और संसाधनों को सार्वजनिक शिक्षा प्रणाली के सामाजिक उद्देश्यों के साथ जोड़कर डिजिटल शिक्षा की गुणवत्ता और पहुँच दोनों को बढ़ाया जा सकता है। यह भागीदारी डिजिटल प्लेटफॉर्म विकास, शिक्षक प्रशिक्षण, सामग्री निर्माण और इंफ्रास्ट्रक्चर विस्तार में सहायक हो सकती है, बशर्ते इसे सामाजिक उत्तरदायित्व और पारदर्शिता के साथ संचालित किया जाए।

### 7.5 नीति-स्तरीय हस्तक्षेप और निगरानी

समावेशी पेडागोजी 4.0 के लिए सुदृढ़ नीति-स्तरीय हस्तक्षेप और प्रभावी निगरानी तंत्र अनिवार्य हैं। डिजिटल शिक्षा से संबंधित नीतियों में समान पहुँच, सुलभता, डेटा गोपनीयता और नैतिकता को केंद्रीय स्थान दिया जाना चाहिए। इसके साथ-साथ, योजनाओं और कार्यक्रमों के क्रियान्वयन की नियमित निगरानी, मूल्यांकन और सुधार से यह सुनिश्चित किया जा सकता है कि तकनीक-आधारित शिक्षा वास्तव में सभी वर्गों तक पहुँच रही है या नहीं।

स्पष्ट है कि समावेशी पेडागोजी 4.0 केवल तकनीकी नवाचार का परिणाम नहीं हो सकती, बल्कि यह सामाजिक, भाषायी और नीतिगत हस्तक्षेपों के समन्वय से ही संभव है। डिजिटल इन्फ्रास्ट्रक्चर, शिक्षक क्षमता, स्थानीय संदर्भ और सशक्त नीतियाँ मिलकर ही तकनीक-आधारित शिक्षा को सामाजिक समानता का साधन बना सकती हैं।
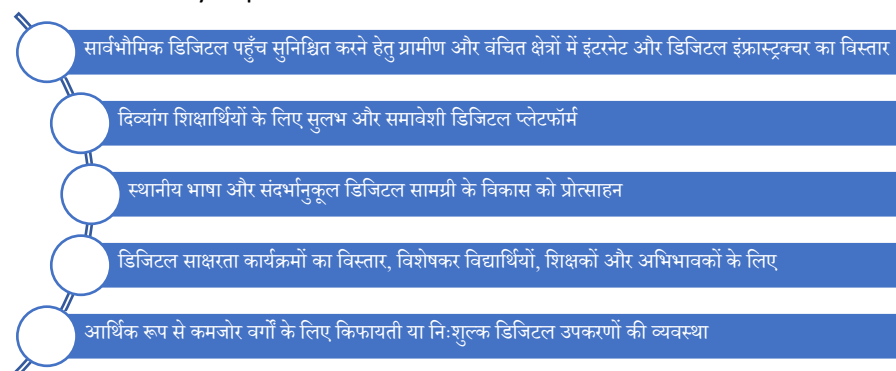
## 8. नीतिगत परिप्रेक्ष्य

पेडागोजी 4.0 और डिजिटल डिवाइड के प्रश्न को केवल तकनीकी या शैक्षिक समस्या के रूप में नहीं, बल्कि नीतिगत और सामाजिक न्याय के संदर्भ में समझना आवश्यक है। समावेशी और न्यायपूर्ण शिक्षा व्यवस्था के निर्माण में नीतियाँ निर्णायक भूमिका निभाती हैं।

### 8.1 राष्ट्रीय शिक्षा नीति 2020 और पेडागोजी 4.0

राष्ट्रीय शिक्षा नीति 2020 भारतीय शिक्षा व्यवस्था को 21वीं सदी की आवश्यकताओं के अनुरूप रूपांतरित करने का प्रयास करती है। यह नीति तकनीक के उपयोग, डिजिटल शिक्षण, ऑनलाइन प्लेटफॉर्म और नवाचार को शिक्षा सुधार का प्रमुख साधन मानती है। राष्ट्रीय शिक्षा नीति 2020 में डिजिटल और ऑनलाइन शिक्षा, मिश्रित अधिगम, शिक्षक प्रशिक्षण, और तकनीक-संचालित मूल्यांकन पर विशेष बल दिया गया है, जो पेडागोजी 4.0 के मूल सिद्धांतों से सीधे जुड़ते हैं। नीति का उद्देश्य शिक्षार्थियों में आलोचनात्मक चिंतन, रचनात्मकता, समस्या-समाधान और आजीवन अधिगम के कौशल विकसित करना है, जो उद्योग 4.0 की माँगों के अनुरूप हैं। हालाँकि, नीति स्वयं यह स्वीकार करती है कि तकनीक का लाभ तभी सार्थक होगा जब उसकी पहुँच समान और समावेशी हो।

### 8.2 डिजिटल समानता को सुनिश्चित करने के उपाय

डिजिटल डिवाइड को कम किए बिना पेडागोजी 4.0 के लक्ष्य प्राप्त नहीं किए जा सकते। इस दिशा में नीतिगत स्तर पर निम्नलिखित उपाय आवश्यक हैं—

- सार्वभौमिक डिजिटल पहुँच सुनिश्चित करने हेतु ग्रामीण और वंचित क्षेत्रों में इंटरनेट और डिजिटल इंफ्रास्ट्रक्चर का विस्तार
- दिव्यांग शिक्षार्थियों के लिए सुलभ और समावेशी डिजिटल प्लेटफॉर्म
- स्थानीय भाषा और संदर्भानुकूल डिजिटल सामग्री के विकास को प्रोत्साहन
- डिजिटल साक्षरता कार्यक्रमों का विस्तार, विशेषकर विद्यार्थियों, शिक्षकों और अभिभावकों के लिए
- आर्थिक रूप से कमजोर वर्गों के लिए किफायती या निःशुल्क डिजिटल उपकरणों की व्यवस्था

चित्र 2. डिजिटल समानता को सुनिश्चित करने के उपाय

इन उपायों के माध्यम से डिजिटल शिक्षा को विशेषाधिकार के बजाय सार्वजनिक अधिकार के रूप में स्थापित किया जा सकता है।

## 8.3 सामाजिक न्याय और शैक्षिक समावेशन

शिक्षा का अंतिम उद्देश्य केवल कौशल विकास नहीं, बल्कि सामाजिक न्याय और समान अवसर सुनिश्चित करना है। पेडागोजी 4.0 यदि डिजिटल डिवाइड को अनदेखा करती है, तो वह सामाजिक असमानताओं को और सुदृढ़ कर सकती है। इसलिए नीतियों में अनुसूचित जाति, अनुसूचित जनजाति, अल्पसंख्यक, ग्रामीण, महिला और दिव्यांग शिक्षार्थियों की विशिष्ट आवश्यकताओं को केंद्रीय स्थान देना आवश्यक है। शैक्षिक समावेशन का अर्थ केवल नामांकन बढ़ाना नहीं, बल्कि गुणवत्तापूर्ण, सुलभ और सम्मानजनक शिक्षा प्रदान करना है। इस संदर्भ में पेडागोजी 4.0 को सामाजिक परिवर्तन के उपकरण के रूप में देखा जाना चाहिए, न कि केवल तकनीकी नवाचार के रूप में।

नीतिगत दृष्टि से स्पष्ट है कि पेडागोजी 4.0 और डिजिटल शिक्षा तभी सफल हो सकती है जब वह समानता, समावेशन और सामाजिक न्याय के मूल्यों से निर्देशित हो। राष्ट्रीय शिक्षा नीति 2020 इस दिशा में एक महत्त्वपूर्ण आधार प्रदान करती है, किंतु इसके प्रभावी क्रियान्वयन के लिए निरंतर निगरानी, संसाधनों का न्यायसंगत वितरण और जमीनी स्तर पर समावेशी दृष्टिकोण अनिवार्य है।

## 9. निष्कर्ष

यह अध्ययन स्पष्ट करता है कि पेडागोजी 4.0 समकालीन शिक्षा व्यवस्था के लिए व्यापक संभावनाएँ लेकर आई है। कृत्रिम बुद्धिमत्ता, डिजिटल प्लेटफॉर्म, लर्निंग एनालिटिक्स और वैयक्तिकृत अधिगम जैसे नवाचारों ने शिक्षण–अधिगम को अधिक लचीला, प्रभावी और शिक्षार्थी-केंद्रित बनाने की क्षमता विकसित की है। पेडागोजी 4.0 न केवल ज्ञान के संप्रेषण के तरीकों को बदलती है, बल्कि शिक्षार्थियों को आलोचनात्मक चिंतन, समस्या-समाधान और आजीवन अधिगम के लिए भी तैयार करती है। इस दृष्टि से यह शिक्षा को 21वीं सदी की सामाजिक और आर्थिक आवश्यकताओं से जोड़ने का एक सशक्त माध्यम बन सकती है। हालाँकि, इस अध्ययन से यह भी स्पष्ट होता है कि पेडागोजी 4.0 की संभावनाओं के साथ-साथ इसकी महत्त्वपूर्ण सीमाएँ भी हैं। तकनीक-आधारित शिक्षा की सफलता इस बात पर निर्भर करती है कि डिजिटल संसाधनों की उपलब्धता, डिजिटल साक्षरता और गुणवत्तापूर्ण सामग्री सभी शिक्षार्थियों तक समान रूप से पहुँच पा रही है या नहीं। डिजिटल डिवाइड—चाहे वह प्रवेश, उपयोग

या गुणवत्ता के स्तर पर हो—तकनीक-आधारित शिक्षा की प्रभावशीलता को गंभीर रूप से सीमित करता है। यदि इन असमानताओं को दूर नहीं किया गया, तो तकनीक शिक्षा का माध्यम बनने के बजाय सामाजिक बहिष्करण का कारक बन सकती है।

अतः यह निष्कर्ष निकलता है कि डिजिटल डिवाइड को पाटे बिना तकनीकी शिक्षा की सफलता अधूरी और असंतुलित रहेगी। केवल तकनीकी नवाचार, ऑनलाइन प्लेटफॉर्म या नीतिगत घोषणाएँ शिक्षा में समानता सुनिश्चित नहीं कर सकतीं। इसके लिए डिजिटल इन्फ्रास्ट्रक्चर का समान विस्तार, शिक्षकों और शिक्षार्थियों की क्षमता निर्माण, स्थानीय भाषा आधारित सामग्री और सुलभ डिजिटल प्लेटफॉर्म अनिवार्य हैं। समग्र रूप से, सामाजिक समानता और शैक्षिक न्याय के लक्ष्य को प्राप्त करने के लिए एक समावेशी तकनीकी दृष्टिकोण की आवश्यकता है। पेडागोजी 4.0 को यदि सामाजिक न्याय, समावेशन और लोकतांत्रिक मूल्यों के साथ जोड़ा जाए, तो यह शिक्षा को सशक्तिकरण का माध्यम बना सकती है। अन्यथा, यह जोखिम बना रहेगा कि तकनीक-आधारित शिक्षा समाज में विद्यमान असमानताओं को कम करने के बजाय उन्हें और गहरा कर दे। इसलिए, पेडागोजी 4.0 का भविष्य उसकी समावेशिता, समानता और मानवीय संवेदनशीलता पर निर्भर करता है।

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# विज्ञान शिक्षक शिक्षा में सुधारों की एक समालोचनात्मक पड़ताल

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## सार

इस शोध का मुख्य उद्देश्य भारत में विज्ञान शिक्षक शिक्षा से संबंधित नीतियों और उनके व्यवहारिक क्रियान्वयन के बीच के अंतर को पहचानना और उसका विश्लेषण करना है। इस शोध के केंद्र में ये प्रश्न है कि क्या केवल नई नीतियों का निर्माण विज्ञान शिक्षक शिक्षा की गहरी समस्याओं का समाधान कर सकता है। साथ ही, यह अध्ययन यह भी जांचता है कि पिछले एक दशक (2014–2024) के नीतिगत परिवर्तनों ने विज्ञान शिक्षक शिक्षा की गुणवत्ता पर क्या प्रभाव डाला है। शोध*विधि* के *अंतर्गत* गुणात्मक दृष्टिकोण अपनाते हुए विज्ञान शिक्षक शिक्षा से सम्बंधित नीतिगत दस्तावेज़ों, रिपोर्टों और सरकारी पहलों का विश्लेषण किया गया। साथ ही, विज्ञान शिक्षक शिक्षा से जुड़े पाठ्यक्रम और प्रशिक्षण संरचना की समीक्षा की गई। इसमें विशेष रूप से शिक्षण शास्त्र और ज्ञानमीमांसा जैसे शैक्षिक घटकों की मौजूदगी और अनुपस्थिति पर *पर जानकारी एकत्र करने के लिए* छात्र-शिक्षकों और शिक्षक प्रशिक्षकों *का साक्षात्कार* किया गया। अध्ययन में पाया गया कि यद्यपि एन*ईपी* 2020 और अन्य नीतिगत सुधारों के तहत पाठ्यक्रम पुनर्रचना, प्रवेश प्रक्रिया का मानकीकरण और प्रशिक्षण की अवधि में बदलाव किए गए, लेकिन विज्ञान शिक्षक शिक्षा में मूलभूत शैक्षिक दृष्टिकोण की अनदेखी हुई। अधिकांश शिक्षक प्रशिक्षण कार्यक्रमों में प्रशिक्षुओं को अनुभवजन्य समझ विकसित करने, कक्षा की जटिलताओं को पहचानने, और विज्ञान विषय की गहन बारीकियों को समझने के पर्याप्त अवसर नहीं मिलते (NCFTE, 2009)। नीतियों और ज़मीनी क्रियान्वयन के बीच की खाई विज्ञान शिक्षक शिक्षा की गुणवत्ता को सीमित कर रही है। *निष्कर्ष* में ये सामने आया कि प्रभावी विज्ञान शिक्षकों के निर्माण के लिए केवल ढांचागत या नीतिगत सुधार पर्याप्त नहीं हैं। इसके साथ-साथ गहन शैक्षिक दृष्टिकोण अपनाना, शिक्षण शास्त्र और ज्ञानमीमांसा पर ध्यान देना आवश्यक है। नीतियों के सफल क्रियान्वयन के लिए प्रशिक्षण कार्यक्रमों में अनुभव-आधारित शिक्षण, चिंतनशील अभ्यास, और विषय-विशिष्ट समझ को केंद्र में रखना होगा, ताकि विज्ञान शिक्षक शिक्षा वास्तव में गुणवत्तापूर्ण और प्रभावी बन सके।

मुख्य शब्द: विज्ञान शिक्षक शिक्षा, सेवा पूर्व शिक्षक शिक्षा, शिक्षक गुणवत्ता, बी एड पाठ्यक्रम, शिक्षणशास्त्र।

## 1. पृष्ठभूमि

वर्तमान वैश्विक परिप्रेक्ष्य में गुणवत्तापूर्ण शिक्षक शिक्षा को किसी भी राष्ट्र की प्रगति का आधार स्तंभ माना जाता है। विशेष रूप से विज्ञान शिक्षा के क्षेत्र में, जहाँ तेजी से बदलती वैज्ञानिक जानकारियाँ, कौशल एवं दृष्टिकोण की आवश्यकता होती है, वहाँ विज्ञान शिक्षक-प्रशिक्षकों की भूमिका अत्यंत महत्वपूर्ण हो जाती है। भारत में विज्ञान शिक्षक शिक्षा की गुणवत्ता को लेकर चिंतन एक लंबी ऐतिहासिक प्रक्रिया का हिस्सा रहा है। परंतु बीते एक दशक में (विशेषकर 2014 के बाद) इस क्षेत्र में कई संरचनात्मक और नीतिगत हस्तक्षेप सामने

आए, जिनका उद्देश्य था विज्ञान शिक्षकों की तैयारी को अधिक उत्तरदायी, व्यावसायिक और नवाचारपरक बनाना। राष्ट्रीय शिक्षा नीति 2020 भी ऐसे ही कई लक्ष्यों को निर्धारित करती है इस पर्चे में मुख्य शोध प्रश्न यह है कि वर्तमान नीतिगत ढांचे और व्यावहारिक पहल कैसे उच्च प्राथमिक और माध्यमिक स्तरों पर विज्ञान शिक्षक शिक्षा की गुणवत्ता में दीर्घकालिक सुधार को संबोधित कर रहे हैं।

"विज्ञान शिक्षक-प्रशिक्षक विज्ञान शिक्षण में वैज्ञानिक दृष्टिकोण और आलोचनात्मक सोच को बढ़ावा देते हैं" (भारत सरकार, 2020) और एक योग्य विज्ञान शिक्षक प्रशिक्षक वैज्ञानिक दृष्टिकोण, नवाचार और आलोचनात्मक चिंतन को बढ़ावा देने में सहायक होता है। यह अध्ययन विशेष रूप से विज्ञान शिक्षा के संदर्भ में राष्ट्रीय शिक्षा नीति 2020 द्वारा प्रस्तावित शिक्षक शिक्षा सुधारों के कार्यान्वयन की समालोचनात्मक जांच करेगा और यह अन्वेषण करेगा कि ये सुधार उपयुक्त और प्रशिक्षित विज्ञान शिक्षकों की तैयारी से जुड़ी चुनौतियों को किस हद तक हल कर रहे हैं।

इस क्रम की शुरुआत को समझने के लिए हमें थोड़ी पीछे जाकर शिक्षा का अधिकार अधिनियम, 2009 (आरटीई ऐक्ट) की ओर देखना होगा। इस अधिनियम ने 6 से 14 वर्ष तक की आयु के बच्चों को निशुल्क और अनिवार्य शिक्षा का अधिकार दिया, और इसके साथ ही यह भी स्पष्ट किया गया कि गुणवत्तापूर्ण शिक्षा केवल *प्रशिक्षित शिक्षकों* के माध्यम से ही संभव है (आरटीई ऐक्ट, 2009)। यद्यपि आरटीई प्राथमिक शिक्षा तक सीमित था, परंतु इसने शिक्षक शिक्षा, विशेषकर *प्रशिक्षकों की योग्यता* और *पूर्व-सेवा प्रशिक्षण* की गुणवत्ता को राष्ट्रीय विमर्श का विषय बना दिया।

इसी पृष्ठभूमि में राष्ट्रीय शिक्षक शिक्षा परिषद (एनसीटीई) ने 2009 में "शिक्षक शिक्षा के लिए राष्ट्रीय पाठ्यचर्या रूपरेखा" (एनसीएफटीई, 2009) जारी की। इसमें शिक्षक को केवल पाठ पढ़ाने वाला नहीं, बल्कि एक विचारशील, चिंतनशील, और समाज-संवेदी पेशेवर के रूप में देखा गया। विशेष रूप से विज्ञान शिक्षकों के लिए यह ज़रूरी माना गया कि वे प्रयोगात्मक शिक्षण, अवधारणात्मक स्पष्टता और वैज्ञानिक दृष्टिकोण को विकसित करने में सक्षम हों (एनसीटीई, 2009)।

हालांकि इस रूपरेखा के बावजूद, देश में निजी और निम्न गुणवत्ता वाले शिक्षक प्रशिक्षण संस्थानों की बाढ़ आ गई। इस समस्या की गंभीरता को देखते हुए 2012 में सरकार ने जस्टिस वर्मा समिति का गठन किया। इस समिति की रिपोर्ट (2012) ने यह स्पष्ट किया कि अधिकांश शिक्षक शिक्षा संस्थान केवल प्रमाण पत्र देने वाले बन गए हैं, जिनमें विषय की समझ, स्कूल इंटर्नशिप और शिक्षण शास्त्र की गुणवत्ता की भारी कमी है। रिपोर्ट ने यह सुझाव दिया कि शिक्षक शिक्षा को विश्वविद्यालय प्रणाली से जोड़ा जाए और विषय-आधारित एकीकृत पाठ्यक्रम प्रारंभ किए जाएँ – जो विज्ञान जैसे विशिष्ट विषयों के लिए विशेष रूप से प्रासंगिक थे।

इन आलोचनाओं और सुझावों के पश्चात एनसीटीई ने 2014 में एक नया पाठ्यचर्यात्मक ढांचा प्रस्तुत किया, जिसमें दो वर्षीय B.Ed. कार्यक्रम को शामिल किया गया। यह रूपरेखा शिक्षकों को विषय विशेषज्ञता के साथ-साथ शिक्षण कौशल प्रदान करने के लिए तैयार की गई थी। विज्ञान शिक्षकों के लिए इस पाठ्यक्रम में प्रयोगशालाएँ, प्रोजेक्ट कार्य, और स्कूल अनुभव (इंटर्नशिप) जैसे बिंदुओं को जोड़ा गया (एनसीटीई, 2014)।

इन पहलों को व्यापक दृष्टिकोण में समाहित करते हुए राष्ट्रीय शिक्षा नीति 2020 बहुविषयक और समग्र शिक्षा पर विशेष बल देती है, जिससे सेवा-पूर्व शिक्षक शिक्षा में व्यापक सुधार की आवश्यकता उत्पन्न होती है। नीति के तहत प्रस्तावित प्रमुख संरचनात्मक सुधारों में से एक है शिक्षक शिक्षा कार्यक्रमों का गुणवत्तापूर्ण फैलाव, जिसमें कार्यक्रमों की अवधि में परिवर्तन और पाठ्यक्रम का पुनर्गठन शामिल है। राष्ट्रीय शिक्षा नीति 2020 का प्रमुख उद्देय यह था कि 2030 तक सभी शिक्षक केवल *चार वर्षीय एकीकृत कार्यक्रम* (आईटीईपी ) से ही तैयार किये जाएँ विशेष रूप से विज्ञान शिक्षकों के लिए यह कार्यक्रम विषय की गहराई, शिक्षण पद्धतियों की विविधता, और मूल्यांकन में नवाचार को जोड़ता है। एनईपी  2020 ने यह स्पष्ट किया कि शिक्षक अब सूचना-प्रदाता नहीं, बल्कि *सीखने की प्रक्रिया के उत्प्रेरक होंगे – जो खोज, अन्वेषण और प्रयोग के माध्यम से बच्चों में वैज्ञानिक चेतना विकसित करेंगे (भारत सरकार, 2020, p. 15-17) । इसी दौरान, एनसीटीई ने 2021 में "शिक्षक शिक्षा संस्थानों के लिए दिशा-निर्देश" भी जारी किए, जिनमें मूल्यांकन आधारित अनुमोदन प्रणाली, संकाय योग्यता, और बुनियादी अवसंरचना के मानक स्पष्ट रूप से निर्धारित किए गए। ये दिशा-निर्देश विज्ञान शिक्षक शिक्षा की गुणवत्ता को सुनिश्चित करने के उद्देश्य से तैयार किए गए थे।

परिशिष्ट में टेबल 1 में एक व दो वर्षीय बी.एड. पाठ्यक्रमों में हुए परिवर्तनों और उनके प्रभावों का तुलनात्मक विश्लेषण देखा जा सकता है। इस टेबल के अध्ययन  से पाठ्यक्रम अवधि और उसके प्रभावों की एक समझ मिलती है, जो नीतिगत सुधारों और उनके व्यावहारिक प्रभावों का मूल्यांकन करने में सहायक है। पिछले एक दशक (2014-2024) में भारत में शिक्षक शिक्षा के क्षेत्र में खासकर सेवा पूर्व शिक्षक शिक्षा के क्षेत्र में बहुत से बदलाव देखने को मिले हैं जैसे 2014 से पहले बी एड एक वर्ष का होता था लेकिन एनसीटीई विनियमन 2014 के तहत उसे दो वर्षीय कार्यक्रम में तब्दील किया गया  ताकि भावी शिक्षकों को अधिक व्यापक प्रशिक्षण दिया जा सके और वह स्कूलों में शिक्षण अधिगम प्रक्रिया को बेहतर तरीके से समझ सके हालांकि बदलाव के बावजूद विज्ञान-शिक्षण की ज्ञानमीमांसा को सही तरह से पाठ्यक्रम में शामिल नहीं किया गया अधिकतर बी एड कॉलेजों ने पाठ्यक्रम की संरचना में ही बदलाव किया जबकि इसकी प्रभावशीलता को सुनिश्चित करने के लिए सुधार की आवश्यकता है।

इन सभी नीतिगत कदमों और ढाँचागत सुधारों के बावजूद, जमीनी स्तर पर अनेक चुनौतियाँ बनी हुई हैं  जैसे कि प्रयोगशालाओं की कमी, प्रशिक्षकों की असमान उपलब्धता, पाठ्यक्रम की कार्यान्वयन क्षमताओं में अंतर, और मूल्यांकन की पारंपरिक विधियाँ। विशेष रूप से विज्ञान शिक्षक शिक्षा में नवाचार की गुंजाइश होने के बावजूद उसे संस्थागत रूप से समर्थन नहीं मिल पाया है।

इस शोध का उद्देश्य इसी पृष्ठभूमि में 2014 से 2024 तक की शिक्षा नीतियों, आयोगों और ढाँचागत दस्तावेजों की समालोचनात्मक समीक्षा करना है, ताकि यह समझा जा सके कि इन नीतियों ने विज्ञान शिक्षक की पूर्व-सेवा शिक्षा की गुणवत्ता को किस हद तक प्रभावित किया है। यह अध्ययन न केवल नीतियों के प्रभावों को जांचेगा, बल्कि उन अंतर्विरोधों को भी उजागर करेगा जो नीति और व्यवहार के बीच मौजूद हैं।

## 2. स्कूली स्तर पर विज्ञान शिक्षा: नीतिगत प्रयास

भारत में विज्ञान शिक्षक शिक्षा को लेकर समय-समय पर कई नीतिगत प्रयास किए गए हैं जिनका उद्देश्य न केवल विषय की जानकारी देना बल्कि वैज्ञानिक दृष्टिकोण, प्रयोगात्मक समझ, और सामाजिक संदर्भ के प्रति संवेदनशीलता विकसित करना रहा है। कोठारी आयोग (1964–66) ने विज्ञान शिक्षक को केवल जानकारी देने वाला नहीं, बल्कि सोचने, जाँचने और प्रश्न पूछने की क्षमता को प्रेरित करने वाला बताया। आयोग ने सुझाव दिया  कि विज्ञान शिक्षक शिक्षा में विषय की गहराई, प्रयोगात्मक कार्य और प्रभावी मूल्यांकन शामिल किया जाना चाहिए, और प्रशिक्षण कार्यक्रमों का कम से कम 20% भाग व्यावहारिकता पर आधारित होना चाहिए (भारत सरकार, 1966)।

राष्ट्रीय शिक्षक आयोग (1983–85), जिसे चट्टोपाध्याय आयोग के नाम से जाना जाता है, ने यह स्पष्ट किया कि विद्यालयी जीवन की वास्तविकताओं से जुड़ाव और अनुभवजन्य अधिगम शिक्षक निर्माण की एक प्राथमिक आवश्यकता है। आयोग ने ज़ोर दिया कि शिक्षक प्रशिक्षण पाठ्यक्रमों को ऐसा बनाया जाए, जिससे भविष्य के शिक्षक स्कूलों की सामाजिक, सांस्कृतिक और शैक्षणिक वास्तविकताओं से निरंतर संवाद कर सकें। विज्ञान शिक्षकों के संदर्भ में आयोग ने यह विशेष रूप से रेखांकित किया कि उन्हें विषय में गहरी अंतर्दृष्टि के साथ-साथ वैज्ञानिक दृष्टिकोण और खोज  की प्रवृत्ति से युक्त होना चाहिए। आयोग ने यह भी अनुशंसा की कि विज्ञान शिक्षकों को केवल पाठ्यपुस्तक आधारित ज्ञान देने वाले के रूप में नहीं, बल्कि वैज्ञानिक सोच विकसित करने वाले मार्गदर्शक के रूप में प्रशिक्षित किया जाना चाहिए। इसी क्रम में, 1986 की राष्ट्रीय शिक्षा नीति ने विकेंद्रीकरण और स्थानीय आवश्यकताओं के अनुरूप विज्ञान शिक्षक प्रशिक्षण के स्वरूप को स्वीकार किया और यह माना कि विज्ञान शिक्षक को प्रयोग, विश्लेषण और समस्या समाधान की क्षमता से युक्त होना चाहिए (भारत सरकार, 1986)।

1990 में राममूर्ति समिति ने यह स्पष्ट किया कि नवप्रशिक्षित विज्ञान शिक्षक को अनुभवी शिक्षकों के निर्देशन में एक संरचित मेंटरिंग व्यवस्था से गुजरना चाहिए, जिससे वह व्यावहारिक समस्याओं का समाधान सीख सके (भारत सरकार, 1990)। वहीं यशपाल समिति (1993) ने आलोचना की कि जानकारी-केंद्रित रटंत शिक्षा ने विज्ञान को बोझिल बना दिया है। इसलिए यह जरूरी है कि शिक्षक जिज्ञासा को बढ़ावा दे और स्वयं वैज्ञानिक दृष्टिकोण से युक्त हो (यशपाल समिति, 1993)। इसका विस्तार 2005 की राष्ट्रीय पाठ्यचर्या रूपरेखा (एनसीएफ 2005) ने  शिक्षक को 'चिंतनशील अभ्यासकर्ता' के रूप में किया। , जो छात्रों के अनुभवों और उनकी पृष्ठभूमि का उपयोग करके उन्हें प्रयोगात्मक रूप से सीखने के लिए प्रेरित करता है (एनसीईआरटी, 2005)। यह दृष्टिकोण विज्ञान शिक्षक शिक्षा को छात्र-केंद्रित और संदर्भ-संवेदनशील बनाता है। राष्ट्रीय पाठ्यचर्या रूपरेखा 2005 के प्रभावी कार्यान्वयन के उद्देश्य से एनसीईआरटी ने वर्ष 2006 में विभिन्न विषयों पर फोकस समूह की रिपोर्टें प्रकाशित कीं। इनमें "विज्ञान शिक्षा पर फोकस समूह की स्थिति-पत्र" में यह रेखांकित किया गया कि विज्ञान शिक्षक प्रशिक्षण संस्थानों में विषय-विशेषज्ञता, चिंतनशीलता तथा नवाचार की प्रवृत्ति का गंभीर अभाव है। इस

कारण, प्रशिक्षक न तो शिक्षार्थियों में वैज्ञानिक दृष्टिकोण विकसित कर पाते हैं और न ही शिक्षण-पद्धतियों में अपेक्षित विविधता ला पाते हैं (एनसीईआरटी , 2006)।

शिक्षक शिक्षा के लिए राष्ट्रीय पाठ्यचर्या रूपरेखा (एनसीएफटीई , 2009) ने शिक्षक की भूमिका को केवल पाठ्य-सामग्री प्रस्तुत करने वाले के रूप में नहीं देखा, बल्कि उसे एक चिंतनशील , सामाजिक-सांस्कृतिक रूप से संवेदनशील, और नवाचारी व्यक्ति के रूप में परिभाषित किया है, जो वैज्ञानिक दृष्टिकोण अपनाने में सक्षम हो तथा वैकल्पिक और समग्र मूल्यांकन विधियों का प्रयोग कर सके। इस रूपरेखा में विज्ञान शिक्षक को एक ऐसा शोधकर्ता और सामाजिक परिवर्तनकामी पेशेवर (एजेंट फॉर सोशल चेंज ) माना गया है, जो विज्ञान शिक्षण को केवल ज्ञानांतरण नहीं, बल्कि समाज से संवाद का माध्यम बनाता है।

राष्ट्रीय शिक्षा नीति 2020 इस रेखा को आगे बढ़ाते हुए विज्ञान शिक्षा को अनुभवजन्य, खोजपरक और रचनात्मक बनाने पर बल देती है। यह नीति पारंपरिक व्याख्यान पद्धति को त्यागकर आलोचनात्मक सोच, समस्या-समाधान और रचनात्मकता को प्राथमिकता देती है। इसमें अंतःविषय दृष्टिकोण और विषयों की पारंपरिक सीमाओं को समाप्त कर समग्र अधिगम की बात की गई है (भारत सरकार, 2020) । इस नीति में यह समझ उभरती है कि छात्रों को केवल विज्ञान पढ़ाना पर्याप्त नहीं, बल्कि उन्हें विज्ञान जीने के लिए तैयार करना है।

यही नीतिगत निरन्तरता एनसीएफ 2023 में भी बनी हुई है इसमें भी विज्ञान शिक्षा को जानकारी देने तक सीमित रखने के बजाय वैज्ञानिक दृष्टिकोण, जिज्ञासा और व्यावहारिक कौशल विकसित करने पर बल दिया गया है। इसमें प्रश्न पूछने, अवलोकन करने, परिकल्पना बनाने, प्रयोग करने और डेटा विश्लेषण के माध्यम से तार्किक सोच को प्रोत्साहित किया गया है। विज्ञान को समाज से जोड़ने के प्रयास में छात्रों को नवाचार और समस्याओं के समाधान के लिए प्रेरित किया गया है, जिससे वे इसे जीवन का अभिन्न अंग मान सकें। इसमें यह भी कहा गया है कि विज्ञान शिक्षक को जिज्ञासा को उभारने वाला, आलोचनात्मक सोच को बढ़ावा देने वाला, और प्रयोगों के माध्यम से सीखने को बढ़ावा देने वाला होना चाहिए (एनसीईआरटी , 2023, पृ. 39–42) ।

हालांकि, इन नीतिगत सिफारिशों के बावजूद, व्यवहारिक स्तर पर कई चुनौतियाँ बनी हुई हैं-

● विद्यालयों में पारंपरिक व्याख्यान-आधारित शिक्षण अब भी हावी है, जबकि नीतियाँ अनुभवजन्य और गतिविधि-आधारित शिक्षण को प्रोत्साहित करती हैं।

● अधिकांश शिक्षक प्रशिक्षण संस्थान व्यावसायिक विकास और इंटर्नशिप जैसे व्यावहारिक तत्वों को प्रभावी ढंग से लागू करने में असफल रहे हैं।

● विद्यालय स्तर पर होने वाले नवाचार शिक्षक शिक्षा पाठ्यक्रम में समुचितरूप से परिलक्षित नहीं होते, जिससे ज्ञान के प्रवाह में बाधा आती है।

विज्ञान शिक्षक शिक्षा में गुणवत्ता सुधार के लिए नीतिगत सिफारिशों और वास्तविक क्रियान्वयन के बीच मौजूद खाई को पाटने की आवश्यकता है। इसके लिए केवल पाठ्यक्रम परिवर्तनों की ही नहीं, बल्कि व्यावहारिक दृष्टिकोण, शिक्षक प्रशिक्षण की गुणवत्ता, और

विद्यालय तथा विश्वविद्यालय के बीच गहरे सहयोग की भी आवश्यकता है। यही प्रयास विज्ञान शिक्षक शिक्षा को अधिक प्रासंगिक, प्रभावी और भविष्य-उन्मुख बना सकते हैं।

उपरोक्त चर्चा एक शोध समस्या को इंगित करती है: *भारत में विज्ञान शिक्षक शिक्षा से जुड़ी नीतियों और उनके व्यावहारिक क्रियान्वयन के बीच स्पष्ट अंतर मौजूद है, जिसके कारण नीतिगत सुधार अपेक्षित परिणाम नहीं दे पा रहे। शिक्षण शास्त्र और ज्ञानमीमांसा जैसे मूलभूत तत्वों की उपेक्षा प्रशिक्षुओं की गहन विषयगत और अनुभवजन्य समझ के विकास में बाधा डाल रही है। यह शोध इस अंतर की प्रकृति और उसके विज्ञान शिक्षक शिक्षा की गुणवत्ता पर पड़ने वाले प्रभाव की पड़ताल करता है।*

इस शोध समस्या के लिए यहाँ कुछ चुनिंदा साहित्य की समीक्षा की गई । बत्रा (2014) अपने लेख में शिक्षक शिक्षा की वर्तमान संरचना की आलोचनात्मक समीक्षा करती हैं और यह उजागर करती हैं कि आज के शिक्षक शिक्षा कार्यक्रम एक कमजोर ज्ञानमीमांसात्मक ढाँचे पर आधारित हैं। लेख में यह तर्क प्रमुखता से उभर कर आता है कि इन कार्यक्रमों की योजना बनाते समय ज्ञान के स्रोत, प्रकृति और निर्माण की गंभीर समझ को नजरअंदाज किया गया है, जिससे भावी शिक्षकों के बौद्धिक विकास में बाधा आती है। लेख का एक केंद्रीय मुद्दा विषय और शिक्षण के बीच का अलगाव है, जो पाठ्यक्रम की संरचना में ही अंतर्निहित है। इस अलगाव के कारण शिक्षक अक्सर पाठ्यपुस्तक पर अत्यधिक निर्भर हो जाते हैं और विषय-वस्तु की गहराई में जाकर उसकी आलोचनात्मक समझ विकसित नहीं कर पाते।

इसके अतिरिक्त, लेख में थ्योरी और प्रैक्टिस के बीच की खाई को भी प्रमुख समस्या के रूप में चिह्नित किया गया है, जहाँ सैद्धांतिक ज्ञान केवल औपचारिकता में सीमित रह जाता है और कक्षा-कक्ष के वास्तविक संदर्भों से उसका कोई जीवंत संबंध नहीं बन पाता। लेख इस बात पर ज़ोर देता है कि शिक्षक शिक्षा कार्यक्रमों को मजबूत ज्ञानमीमांसात्मक आधार पर पुनर्निर्मित करने की आवश्यकता है ताकि वे भावी शिक्षकों को केवल तकनीकी दक्षता नहीं, बल्कि सामाजिक रूप से जागरूक, चिंतनशील और व्यावहारिक रूप से सक्षम शिक्षक बना सकें। यह लेख शिक्षक शिक्षा में ज्ञान, सिद्धांत और अभ्यास के बीच के संबंधों की पुनर्समीक्षा की माँग करता है और इस दिशा में गहराई से सोचने के लिए एक सशक्त आलोचनात्मक हस्तक्षेप प्रदान करता है (बत्रा, 2014)।

इसी संदर्भ में, भारत में शिक्षक शिक्षा से जुड़ी नीतियाँ केवल ज्ञान और वास्तविक ज़रूरतों के आधार पर निर्मित नहीं होतीं, बल्कि यह क्षेत्र राजनीतिक बहसों, गुटबाज़ी और नीतिगत दबावों से भी गहराई से प्रभावित रहता है (शर्मा, 2019)। यह संदर्भ विशेष रूप से विज्ञान शिक्षक शिक्षा में और भी प्रासंगिक हो जाता है, क्योंकि सुधारों की प्रभावशीलता तब तक सीमित रहेगी, जब तक शिक्षक को केवल पाठ्यक्रम लागू करने वाला निष्क्रिय कार्यकर्ता मानने की प्रवृत्ति बनी रहे। जैसा कि बत्रा (2012) ने इंगित किया है, शिक्षक की आवाज़ और उसकी पेशेवर भूमिका को पाठ्यचर्या रूपरेखा में गंभीरता से शामिल किए बिना किसी भी शैक्षिक सुधार की सफलता अधूरी रह जाती है।

आठ राज्यों में शिक्षक प्रशिक्षकों और छात्र-शिक्षकों की स्थिति के सर्वेक्षण पर आधारित एक रिपोर्ट. स्टेट ऑफ टीचर्स, टीचिंग एंड टीचर एजुकेशन फॉर इंडिया रिपोर्ट **2023. (**सेंटर ऑफ एक्सीलेंस इन टीचर एजुकेशन, **2023)** इस स्थिति की एक स्पष्ट तस्वीर प्रस्तुत

करता है, जिसमें आठ राज्यों के शिक्षक-शिक्षकों और छात्र-शिक्षकों के अनुभवों और संस्थागत परिस्थितियों का विश्लेषण किया गया है। रिपोर्ट में यह सामने आया कि शिक्षक-शिक्षा संस्थानों में बुनियादी संसाधनों, प्रयोगशालाओं और पुस्तकालय सुविधाओं की कमी, मेंटरशिप और सतत फीडबैक के अभाव, तथा पाठ्यक्रम व प्रशिक्षण में स्थानीय संदर्भों और विविधता के सीमित समावेश जैसी गंभीर चुनौतियाँ मौजूद हैं। ये चुनौतियाँ न केवल शिक्षक-शिक्षा की गुणवत्ता को प्रभावित करती हैं, बल्कि भावी विज्ञान शिक्षकों की व्यावसायिक तैयारी और नवाचार क्षमता को भी बाधित करती हैं।

यह परिदृश्य केवल भारत तक सीमित नहीं है। दक्षिण एशिया के अधिकांश देशों में शिक्षक-शिक्षा प्रणाली संसाधनों की कमी, अत्यधिक नियमन और पारंपरिक व्याख्यान-आधारित पद्धतियों पर आधारित है, जो समावेशी शिक्षा को बढ़ावा देने वाली नीतियों के विपरीत है (रामचन्द , 2024, **पृ**. 3)। इस प्रकार, क्षेत्रीय और राष्ट्रीय स्तर पर शिक्षक शिक्षा की चुनौतियाँ एक-दूसरे से जुड़ी हुई हैं और इनके समाधान के लिए केवल नीतिगत घोषणाएँ पर्याप्त नहीं, बल्कि संरचनात्मक सुधार, शिक्षक की सक्रिय भागीदारी, और स्थानीय-सांस्कृतिक संदर्भों का गहन एकीकरण आवश्यक है

## 3. मुख्य शोध प्रश्र

● वर्तमान नीतिगत ढांचे का उच्च प्राथमिक और माध्यमिक स्तरों पर विज्ञान शिक्षक शिक्षा की गुणवत्ता पर क्या असर पड़ा है?

● विज्ञान शिक्षकों की तैयारी को शिक्षक शिक्षा के नए कार्यक्रम किस प्रकार से संबोधित करते हैं?

## 4. शोध उद्देश्य

बी.एड. प्रशिक्षुओं और प्रशिक्षकों की प्रतिक्रियाओं के आधार पर यह समझना कि व्यावहारिक शिक्षण की वास्तविक स्थिति क्या है और किस प्रकार इसे बेहतर बनाया जा सकता है।

● यह अध्ययन करना की नीतिगत स्तर पर विज्ञान शिक्षक शिक्षा में क्या संरचनात्मक और पाठ्यचर्या आधारित सुधार किए गए हैं।

● यह विश्लेषण करना कि बी.एड. पाठ्यक्रम में व्यावहारिक शिक्षण, प्रयोगशाला कार्य और गतिविधि आधारित शिक्षण को किस हद तक लागू किया गया है।

● उच्च प्राथमिक और माध्यमिक स्तर पर विज्ञान शिक्षक शिक्षा कार्यक्रमों की गुणवत्ता में हुए परिवर्तनों  को चिह्नित करना और उनका विश्लेषण करना।

● विज्ञान शिक्षकों की शैक्षणिक और व्यावसायिक तैयारियों में आए बदलावों को जानना, विशेषकर प्रशिक्षण की प्रक्रिया के संदर्भ में।

● यह समझना कि विज्ञान शिक्षकों की व्यावहारिक और सैद्धांतिक समझ को नए प्रस्तावित  शिक्षक शिक्षा कार्यक्रम किस प्रकार प्रभावित कर रहे हैं?

## 5. शोध पद्धति

इस शोध में गुणात्मक दृष्टिकोण अपनाया गया है, जिससे नीतिगत ढांचे, पाठचर्या और विज्ञान शिक्षक शिक्षा कार्यक्रमों के प्रभावों का गहराई से विश्लेषण किया जा सके। शोध के उद्देश्यों को प्राप्त करने के लिए नीतिगत विश्लेषण, पाठचर्या विश्लेषण और साक्षात्कार का समावेश किया गया है।

नीतिगत विश्लेषण के अंतर्गत 2005 के बाद के विभिन्न नीतिगत दस्तावेजों का अध्ययन किया गया, जिनमें राष्ट्रीय पाठचर्या रूपरेखा 2005, राष्ट्रीय शिक्षा नीति 2020 और राष्ट्रीय पाठचर्या रूपरेखा 2023 शामिल हैं। इन दस्तावेजों का अध्ययन कर यह समझने का प्रयास किया गया कि विज्ञान शिक्षक शिक्षा से संबंधित क्या अपेक्षाएँ प्रस्तुत की गई हैं और उनमें क्या बदलाव आए हैं। ये विश्लेषण बताता है कि विज्ञान शिक्षक शिक्षा से जुड़े नीतिगत निर्देशों, मानकों और अनुशंसाओं की प्रकृति क्या है? इसके साथ ही यह भी पता चलता है कि 2005 से 2023 तक विज्ञान शिक्षक शिक्षा में नीतिगत स्तर पर क्या बदलाव हुए। इस क्रम में विभिन्न विश्वविद्यालयों में लागू विज्ञान शिक्षक शिक्षा कार्यक्रमों के पाठ्यक्रमों का अध्ययन किया गया और शिक्षक प्रशिक्षण में प्रायोगिक कार्य, व्यावहारिक शिक्षण और आधुनिक तकनीकों के समावेश को समझने का प्रयास भी किया गया।

शोध में प्राथमिक डेटा संग्रह के लिए छात्र-शिक्षकों और शिक्षक प्रशिक्षकों से साक्षात्कार लिए गए। शिक्षक शिक्षा कार्यक्रमों में अध्ययनरत 21 छात्र-शिक्षकों से साक्षात्कार किया गया। इन साक्षात्कारों का उद्देश्य यह समझना था कि पाठ्यक्रम और प्रशिक्षण की गुणवत्ता कितनी प्रभावी है और व्यावहारिक प्रशिक्षण (इंटर्नशिप, स्कूल-अध्ययन, शिक्षण अभ्यास) कितना उपयोगी रहा? इसके साथ ही चार शिक्षक प्रशिक्षकों से विस्तृत साक्षात्कार किया गया ताकि यह जाना जा सके कि विज्ञान शिक्षक शिक्षा में नीतिगत बदलावों के कारण शिक्षण पद्धतियों में क्या परिवर्तन हुए हैं?

## 6. शोध परिणाम

### 6.1 शिक्षक शिक्षा के लिए राष्ट्रीय पाठचर्या रूपरेखा में बदलाव और विज्ञान शिक्षक प्रशिक्षण:

विभिन्न एनसीएफ ने जहाँ अनुभवजन्य, परियोजना-आधारित और समावेशी शिक्षण पद्धतियों पर जोर दिया, वहीं एनसीएफटीई ने शिक्षक प्रशिक्षण को व्यावसायिक विकास, व्यावहारिक प्रशिक्षण और इंटर्नशिप के माध्यम से सशक्त बनाने की दिशा में कार्य किया। दोनों रूपरेखाओं ने यह सुनिश्चित करने का प्रयास किया कि विज्ञान शिक्षक न केवल विषय की गहरी समझ रखें, बल्कि प्रभावी शिक्षण कौशल और व्यावहारिक दृष्टिकोण से भी युक्त हों।

भारत सरकार और राष्ट्रीय शिक्षा परिषद् एनसीटीई ने 2014 में बी एड पाठ्यक्रम में बड़े बदलाव किए जिसके अंतर्गत बी एड पाठ्यक्रम को एक वर्ष से बढ़ाकर दो वर्ष का किया गया इसके बाद राष्ट्रीय शिक्षा नीति 2020 के तहत इसे 4 वर्षीय एकीकृत कोर्स में बदल दिया गया। हालांकि सुधार का उद्देश्य शिक्षक प्रशिक्षण को अधिक व्यापक, व्यावहारिक और गुणवत्तापूर्ण बनाना था पर इतने मात्र से यह सुनिश्चित नहीं हो जाता की विज्ञान शिक्षकों को प्रयोग आधारित शिक्षण का हुनर हासिल हो जाएगा (**परिशिष्ट 1**)।

2014 से पहले बीएड पाठ्यक्रम में स्कूल इंटर्नशिप 40 दिन के लिए होती थी लेकिन 2014 सुधार के बाद छात्र शिक्षकों के लिए 20 सप्ताह का इंटर्नशिप अनिवार्य कर दिया गया इसके बाद राष्ट्रीय शिक्षा नीति 2020 में शिक्षक प्रशिक्षण में अनुभावात्मक शिक्षण, समस्या आधारित शिक्षण और प्रोजेक्ट आधारित शिक्षण को जोड़ा और स्कूलों में एक वर्ष की लंबी इंटर्नशिप अनिवार्य की गई ताकि शिक्षक वास्तविक परिस्थितियों में शिक्षण कौशल विकसित कर सकें। जिससे भावी शिक्षक कक्षा प्रबंधन, पाठ योजना मूल्यांकन तकनीक को वास्तविक वातावरण में सीख सकें। पर पाठ योजनाओं का निर्माण उसी तरीके से होता रहा। एनसीटीई विनियमन 2014 ने बी एड पाठ्यक्रम में मनोविज्ञान, दर्शनशास्त्र, शिक्षा का समाजशास्त्र और मूल्यांकन पद्धतियां जैसे विषय जोड़े और शिक्षा में सूचना संचार एवं प्रौद्योगिकी के उपयोग को पाठ्यक्रम का हिस्सा बनाया पर यह समझ नहीं बनी की इनका विज्ञान शिक्षा में क्या उपयोग है? पहले केवल लिखित और मौखिक परीक्षा पर जोर दिया जाता था 2014 के बाद से सतत् मूल्यांकन, रचनात्मक आँकलन, केस स्टडी और प्रोजेक्ट वर्क को भी शामिल किया गया। एनसीटीई 2014 के रेग्युलेशन में पाठ्यक्रम को इस प्रकार विकसित किया कि शिक्षक केवल विषय विशेषज्ञ ही नहीं बल्कि प्रभावी संप्रेषक भी बनें (**परिशिष्ट 2**)।

## 6.2 बी.एड. पाठ्यक्रम में प्रमुख व्यवस्थागत सुधार

राष्ट्रीय शिक्षा नीति 2020 और अन्य नियामकीय सुधारों के तहत बी.एड. पाठ्यक्रम में कई व्यवस्थागत परिवर्तन किए गए लेकिन फिर भी शिक्षक प्रशिक्षण संस्थानों में गुणवत्तापूर्ण शिक्षा देने के लिए प्रभावी निरीक्षण और नीति कार्यान्वयन की आवश्यकता बनी हुई है। इसके अलावा, विज्ञान शिक्षकों की सशक्तता के बिना किसी भी शिक्षा सुधार कार्यक्रम की सफलता संभव नहीं है। यदि शिक्षक स्वयं सशक्त और प्रेरित नहीं होंगे, तो वे किसी भी प्रकार के शैक्षिक नवाचार को अपनाने में रुचि नहीं दिखाएंगे। इसलिए, विज्ञान शिक्षक-प्रशिक्षण को आधुनिक कक्षा शिक्षण की आवश्यकताओं के अनुरूप बनाना अनिवार्य है। जब विज्ञान शिक्षक न केवल पाठ्यक्रम की सामग्री में दक्ष होंगे, बल्कि वैज्ञानिक दृष्टिकोण से सोचने, शोध करने और खोजपरक शिक्षण में सक्षम होंगे, तभी विज्ञान शिक्षा का असली उद्देश्य पूरा होगा और छात्र विज्ञान को एक जीवंत, जिज्ञासापूर्ण और सामाजिक रूप से प्रासंगिक विषय के रूप में देख सकेंगे।

## 6.3 विज्ञान शिक्षक शिक्षा के लिए संरचनात्मक परिवर्तन

2014 से 2024 के बीच शिक्षक शिक्षा में कई नियामक और पाठ्यचर्या-आधारित बदलाव किए गए, लेकिन ये मुख्य रूप से संरचनात्मक रहे। शिक्षक शिक्षा की वास्तविक गुणवत्ता में सुधार एक महत्वपूर्ण चुनौती बना हुआ है। पाठ्यचर्या को प्रयोग आधारित विज्ञान शिक्षा के अनुरूप ढालने के प्रयास किए गए, लेकिन शिक्षक प्रशिक्षण संस्थानों की गुणवत्ता, व्यवहारिक प्रशिक्षण की कमी, और मूल्यांकन प्रणाली की कमजोरियों के कारण ये सुधार सीमित प्रभाव डाल सके।

विज्ञान शिक्षक शिक्षा में सुधार हेतु बी.एड. को एक वर्ष की जगह दो वर्ष का किया गया, जिससे की सैद्धांतिक और व्यावहारिक ज्ञान का संतुलन बना रहे और शिक्षकों की दक्षता और शिक्षण कौशल में वृद्धि हो सके।

प्रथम वर्ष में विज्ञान शिक्षा के दार्शनिक आधारों, पाठ्ययोजना निर्माण, विज्ञान शिक्षण के उद्देश्यों और पाठ्यक्रम संगठन पर बल दिया गया। इसके अलावा, उच्च प्राथमिक और माध्यमिक स्तर के लिए जाँच-आधारित शिक्षण, समस्या समाधान और परियोजना कार्यों की योजना को शामिल किया गया। प्रयोगात्मक कार्यों को भी इस चरण में सम्मिलित किया गया, जिससे शिक्षक विज्ञान शिक्षण में अनुसंधान और खोजपरक दृष्टिकोण को अपनाने के लिए प्रेरित हों।

द्वितीय वर्ष में व्यावहारिक पक्ष को मजबूत करने पर ध्यान केंद्रित किया गया। इसमें शिक्षकों को पाठ्यक्रम योजना तैयार करने, प्रयोगशाला का प्रभावी उपयोग करने, शिक्षण संसाधनों को उचित रूप से लागू करने, और वैज्ञानिक अभिवृत्ति को प्रोत्साहित करने का प्रशिक्षण दिया गया। यह चरण शिक्षकों को विविध शिक्षण दृष्टिकोणों, जैसे जाँच-आधारित शिक्षण, अनुकरणीय शिक्षण और समस्या-आधारित शिक्षण, को अपनाने के लिए प्रेरित करता है। हालांकि, नीति में प्रस्तावित सुधारों को लागू करने में अब भी कई चुनौतियाँ बनी हुई हैं।

### 6.4 विज्ञान शिक्षणशास्त्र के पाठ्यक्रम को जमीनी स्तर पर लागू करना

उपरोक्त संरचनात्मक सुधारों के बावजूद, जमीनी स्तर पर वास्तविक चुनौतियाँ बनी हुई हैं, जैसा कि 21 शिक्षक प्रशिक्षुओं के उत्तरों से स्पष्ट होता है। विश्लेषण से पता चला 18 प्रतिभागियों ने पाठ्यक्रम को सैद्धांतिक रूप से अधिक केंद्रित माना, जबकि 3 प्रतिभागियों ने इसे सैद्धांतिक और व्यावहारिक दोनों दृष्टियों से संतुलित पाया।  शोध में शिक्षणशास्त्र के प्राथमिक फोकस को समझने का प्रयास किया गया, जिसमें प्रतिभागियों की प्रतिक्रियाएँ मुख्यतः शिक्षण विधियों एवं पाठ योजना पर केंद्रित रहीं। मूल्यांकन की महत्ता को सीमित संख्या में प्रतिभागियों ने स्वीकार किया। पाठ योजना में गतिविधि-आधारित शिक्षण की भूमिका पर मिले उत्तरों से पता चला कि 15 प्रतिभागियों ने विभिन्न गतिविधियों को सम्मिलित किया, जबकि 6  ने सीमित या कोई अतिरिक्त गतिविधि न जोड़ने की बात कही, जिससे पारंपरिक शिक्षण पद्धतियों की निरंतरता का संकेत मिलता है।

प्रयोगशाला कार्य हेतु निर्धारित समय की उपलब्धता की जाँच में 13 प्रतिभागियों ने "शून्य" उत्तर दिया, जिससे व्यावहारिक शिक्षण की उपेक्षा स्पष्ट हुई। हालांकि, 8 प्रतिभागियों ने पाठ योजनाओं में सीमित अवधि हेतु प्रयोगशाला गतिविधियाँ सम्मिलित कीं। असाइनमेंट की प्रकृति के विश्लेषण से पता चला कि बी.एड. प्रशिक्षण में प्रमुख रूप से सैद्धांतिक असाइनमेंट दिए गए। परियोजना-आधारित असाइनमेंट सीमित रूप में मौजूद थे, जबकि व्यावहारिक असाइनमेंट नगण्य रहे, जिससे शिक्षक प्रशिक्षण में व्यावहारिक अनुभव बढ़ाने की आवश्यकता रेखांकित होती है। प्रैक्टिस टीचिंग में लैब-आधारित शिक्षण की उपलब्धता न्यूनतम पाई गई। अधिकांश प्रशिक्षुओं को लैब में कक्षा संचालन का अवसर नहीं मिला, जबकि कुछ को सीमित अवसर प्राप्त हुए निष्कर्षतः शिक्षक प्रशिक्षण में व्यावहारिक और लैब-आधारित शिक्षण को अधिक समाविष्ट करने की आवश्यकता है, जिससे प्रशिक्षु आधुनिक शिक्षण तकनीकों का प्रभावी उपयोग कर सकें।

## 6.5 पाठ्यक्रम की केन्द्रीयता बनाम क्रियान्वयन

चार शिक्षक प्रशिक्षकों से शिक्षण पद्धतियों और उनके प्रभावों के बारे में जानने के लिए चर्चा की गई, जिसके परिणामस्वरूप विभिन्न दृष्टिकोण सामने आए। एक प्रतिभागी ने बताया की उन्होंने बी एड प्रशिक्षण के दौरान इंडक्टिव मेथड और एक्सपेरिमेंटल मेथड का उपयोग किया, जबकि दूसरे प्रतिभागी ने बताया की उन्होंने विज्ञान शिक्षण के लिए पारंपरिक ऑटोक्रेटिक मेथड को अपनाया। एक अन्य प्रतिभागी ने बताया की उन्होंने गतिविधि-आधारित शिक्षण को प्राथमिकता दी। इसके अतिरिक्त, एक प्रतिभागी ने विज्ञान शिक्षण को अधिक प्रभावी बनाने के लिए टॉय पेडागॉजी, वीडियो, एनीमेशन, सिमुलेशन, लैब-आधारित गेम्स और स्टोरी टेलिंग जैसी नवीन तकनीकों का भी उपयोग किया। प्रतिभागियों से प्राप्त प्रतिक्रियाओं के आधार पर यह स्पष्ट होता है कि हाल के वर्षों में शिक्षण पद्धतियों में डिजिटल संसाधनों और ऑनलाइन शिक्षण के उपयोग में वृद्धि हुई है। हालांकि, शिक्षकों के प्रशिक्षण और कक्षा शिक्षण में इन नवाचारों का पूर्ण रूप से समावेश अब भी सीमित है।

तीन प्रतिभागियों ने यह इंगित किया कि विज्ञान शिक्षकों को नई शिक्षण पद्धतियों का प्रशिक्षण तो दिया जा रहा है, किंतु यह प्रशिक्षण व्यवहारिक दृष्टिकोण से पर्याप्त नहीं है विज्ञान शिक्षण की प्रभावशीलता बढ़ाने के लिए व्यवहारिक प्रशिक्षण, डिजिटल संसाधनों की उपलब्धता और शिक्षकों की मानसिकता में बदलाव आवश्यक है।

शोध निष्कर्षों के अनुसार, डिजिटल संसाधनों और फ्लिप्ड लर्निंग के उपयोग में वृद्धि हुई है, लेकिन पारंपरिक शिक्षण अभी भी हावी है। विज्ञान शिक्षकों के लिए आधुनिक शिक्षण विधियों को अपनाना चुनौतीपूर्ण बना हुआ है, मुख्यतः संसाधनों की कमी और प्रशिक्षण की अपर्याप्तता के कारण शिक्षण में तकनीकी एकीकरण को प्रभावी बनाने हेतु नीतिगत सुधार और संरचनात्मक परिवर्तन आवश्यक हैं।

## 7. निष्कर्ष

*शोध के निष्कर्ष यह दर्शाते हैं कि वर्तमान बी.एड. पाठ्यक्रम अभी भी मुख्यतः सैद्धांतिक ज्ञान पर केंद्रित है, जबकि व्यावहारिक शिक्षण की भूमिका सीमित बनी हुई है। अधिकांश प्रशिक्षु गतिविधि-आधारित शिक्षण को अपनाते हैं, किंतु प्रयोगशाला कार्य, व्यावहारिक असाइनमेंट, लैब-आधारित शिक्षण, विज्ञान मेले, शोध लेखन और वैज्ञानिकों से संवाद जैसे अवसर न्यूनतम हैं। टेबल 2 में तुलनात्मक विश्लेषण से स्पष्ट है कि 2014 से पहले का एक वर्षीय बी.एड. पाठ्यक्रम अवधि, विषयवस्तु और व्यावहारिक अनुभव के मामले में सीमित था, जिसके कारण शिक्षण कौशल और गुणवत्ता में अपेक्षित विकास नहीं हो पाता था। 2014 के बाद लागू द्विवर्षीय पाठ्यक्रम ने अवधि, विषयवस्तु की गहराई, सैद्धांतिक-व्यावहारिक संतुलन, विस्तारित इंटर्नशिप, आधुनिक शिक्षण विधियों, संतुलित मूल्यांकन तथा डिजिटल संसाधनों के प्रयोग से शिक्षक दक्षता और कक्षा प्रबंधन में सुधार की संभावनाएँ बढ़ाईं।*

*हालाँकि, इन नीतिगत और संरचनात्मक सुधारों का प्रभाव ज़मीनी स्तर पर व्यापक रूप से दिखाई नहीं देता, जो क्रियान्वयन की चुनौतियों की ओर संकेत करता है। भारत में विज्ञान शिक्षक शिक्षा से संबंधित नीतिगत सुधार, विशेषकर 2014–2024 के दशक में, एक ओर जहाँ संरचनात्मक और शैक्षिक दृष्टिकोण से नए अवसर प्रस्तुत करते हैं, वहीं दूसरी ओर इनके व्यावहारिक क्रियान्वयन में गंभीर चुनौतियाँ*

सामने आती हैं। राष्ट्रीय शिक्षा नीति 2020, एनसीएफटीई 2009, न्याय वर्मा समिति रिपोर्ट 2012 और **एनसीटीई** के संशोधित मानदंडों ने विज्ञान शिक्षक-प्रशिक्षण को अधिक समग्र, व्यावसायिक और बहुआयामी बनाने का लक्ष्य रखा है।  फिर भी, विश्लेषण से यह स्पष्ट होता है कि—

1. नीतियों के उद्देश्यों और संस्थागत कार्यान्वयन के बीच उल्लेखनीय अंतर मौजूद है।

2. प्रशिक्षण कार्यक्रमों में **ज्ञानमीमांसात्मक गहराई**, **शोध-आधारित शिक्षण कौशल** और **विज्ञान शिक्षण में नवाचार** की कमी है।

3. दो वर्षीय बी.एड. मॉडल ने शिक्षण-अभ्यास की अवधि तो बढ़ाई, लेकिन गुणवत्तापूर्ण मेंटरिंग और विद्यालय-आधारित अनुभव का पर्याप्त विकास नहीं हो पाया।

4. विज्ञान शिक्षा में **प्रयोगात्मक कार्य**, **अन्वेषण-आधारित पद्धतियाँ**, और **मूल्यांकन के वैकल्पिक रूप** अभी भी सीमित रूप में अपनाए जाते हैं।

इस प्रकार,  नीतिगत दस्तावेज़ बताते हैं कि विज्ञान शिक्षक प्रशिक्षण में सुधार की आवश्यकता को पहचानते हुए कई बदलाव किए गए, किंतु केवल सैद्धांतिक ज्ञान पर्याप्त नहीं है। विज्ञान शिक्षकों को प्रयोगशालाओं, नवाचार-आधारित प्रशिक्षण कार्यक्रमों, विज्ञान मेलों और संवादात्मक शिक्षण पद्धतियों से जोड़ना आवश्यक है, ताकि छात्र विज्ञान को एक जिज्ञासापूर्ण और व्यावहारिक विषय के रूप में अपनाएँ। छात्र-शिक्षकों की प्रतिक्रियाएँ यह स्पष्ट करती हैं कि विज्ञान शिक्षक प्रशिक्षण में संरचनात्मक बदलावों के साथ-साथ व्यावहारिक शिक्षण पर गहन और सतत ध्यान देना आवश्यक है। केवल नीतिगत बदलाव से अपेक्षित सुधार संभव नहीं हैं; इनका असर तभी सार्थक होगा जब उन्हें ठोस संसाधनों, प्रशिक्षित संकाय, और सतत मूल्यांकन की संस्कृति के साथ जोड़ा जाए।

## परिशिष्ट 1
टेबल 1:  **पाठ्यक्रम की समय-सीमा में बदलाव**

| वर्ष | पाठ्यक्रम की अवधि | प्रभाव |
|---|---|---|
| **2014 से पहले** | 1 वर्षीय बी.एड. | शिक्षक जल्दी प्रशिक्षित होते थे, लेकिन गुणवत्तापूर्ण शिक्षण में कमी थी। |
| **2014-2020** | 2 वर्षीय बी.एड. | शिक्षण दक्षता बढ़ी, लेकिन कोर्स लंबा होने से छात्रों का शिक्षक शिक्षा के प्रति रुझान घटा। |
| **2020 से अब तक** | 4 वर्षीय एकीकृत बी.एड. | शिक्षक शिक्षा को स्नातक स्तर से ही एकीकृत कर दिया गया। |

## परिशिष्ट 2
टेबल 2:  **बी.एड. पाठ्यक्रम का तुलनात्मक विश्लेषण**

| विश्लेषण का आधार | एक वर्षीय बी.एड. (2014 से पहले ) | द्विवर्षीय बी.एड. (2014 के बाद) | प्रभाव |
|---|---|---|---|
| अवधि | 1 वर्ष | 2 वर्ष | विस्तारित पाठ्यक्रम से शिक्षकों की दक्षता में वृद्धि हुई। |

| विषय चयन (शिक्षणशास्त्र) | दो विषयों का चयन करना अनिवार्य था। | प्रथम वर्ष में दो विषयों का चयन आवश्यक, जो द्वितीय वर्ष में जारी रहते हैं। | विषयवस्तु की गहरी समझ विकसित हुई। |
|---|---|---|---|
| सैद्धांतिक और व्यावहारिक संतुलन | सैद्धांतिक और व्यावहारिक पक्ष को एक ही वर्ष में समाहित किया गया, जिससे सीमित अभ्यास संभव था। | प्रथम वर्ष में सैद्धांतिक अवधारणाएँ, द्वितीय वर्ष में व्यावहारिक शिक्षण पर अधिक बल। | द्विवर्षीय पाठ्यक्रम में शिक्षण-अधिगम प्रक्रिया अधिक प्रभावी हुई। |
| विद्यालय अनुभव (इंटर्नशिप) | सीमित विद्यालय अनुभव, प्रैक्टिस टीचिंग(40 दिन )जिससे व्यावहारिक शिक्षण दक्षता विकसित करने के अवसर कम थे। | विस्तारित इंटर्नशिप, जिसमें शिक्षण अनुभव, नवाचार आधारित शिक्षण विधियाँ सम्मिलित हैं। | शिक्षकों में कक्षा प्रबंधन एवं शिक्षण कौशल में सुधार हुआ। |
| पाठ्यक्रम संरचना | पाठ्यक्रम अपेक्षाकृत संक्षिप्त था, जिसमें शिक्षण सिद्धांत एवं अधिगम प्रक्रिया को सीमित रूप में समाहित किया गया था। | विस्तारित पाठ्यक्रम में शिक्षण-संबंधी सिद्धांतों, शिक्षण विधियों, मूल्यांकन एवं नवीन तकनीकों पर अधिक बल। | शिक्षकों में शिक्षण-अधिगम के व्यापक दृष्टिकोण का विकास |
| शिक्षण विधियाँ | पारंपरिक शिक्षण विधियाँ (व्याख्यान विधि प्रमुख) का उपयोग अधिक था। | जाँच-आधारित शिक्षण, समस्या-आधारित शिक्षण, परियोजना-आधारित शिक्षण को अपनाया गया। | शिक्षण विधियों में विविधता आई, जिससे शिक्षार्थी-केंद्रित शिक्षण संभव हुआ। |
| मूल्यांकन प्रक्रिया | बाह्य मूल्यांकन (थ्योरी पेपर) पर अधिक बल, व्यावहारिक मूल्यांकन सीमित था। | सैद्धांतिक और व्यावहारिक दोनों प्रकार के मूल्यांकन का संतुलन। | शिक्षकों के समग्र मूल्यांकन में सुधार हुआ |
| शिक्षण संसाधनों का उपयोग | शिक्षण संसाधनों का सीमित प्रयोग। | डिजिटल संसाधनों, ICT, स्मार्ट क्लास एवं अन्य आधुनिक उपकरणों पर अधिक ध्यान। | डिजिटल साक्षरता और नवाचार आधारित शिक्षण को बढ़ावा मिला। |
| शिक्षण की गुणवत्ता | अपेक्षाकृत कम, उद्देश्य स्पष्ट नहीं थे। | नवाचार, प्रयोगात्मक शिक्षण एवं गुणवत्तापूर्ण शिक्षण पर बल। | शिक्षकों की दक्षता में वृद्धि हुई, जिससे कक्षा शिक्षण अधिक प्रभावी हुआ। |

नोट: इस तुलनात्मक विश्लेषण से स्पष्ट होता है कि 2014 से पहले एक वर्षीय बी.एड. पाठ्यक्रम अवधि, सामग्री और व्यावहारिक अनुभव, तीनों ही दृष्टियों से सीमित था, इसके विपरीत, 2014 के बाद लागू द्विवर्षीय बी.एड. पाठ्यक्रम ने अवधि, विषयवस्तु की गहराई, सैद्धांतिक-व्यावहारिक संतुलन, विस्तारित इंटर्नशिप, आधुनिक शिक्षण विधियों, संतुलित मूल्यांकन एवं डिजिटल संसाधनों के प्रयोग के

माध्यम से शिक्षक दक्षता, कक्षा प्रबंधन और शिक्षण गुणवत्ता में उल्लेखनीय वृद्धि की। हालांकि, इन सुधारों का वास्तविक प्रभाव ज़मीनी

स्तर पर व्यापक रूप से देखने को नहीं मिला।

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## Courses offered in University Campus

**D. Litt., D.Sc., Ph.D. (Full Time, Part time, Integrated)**

**M.A.**

- Regional Economics
- Ancient History & Culture
- English
- Psychology
- Philosophy
- Commerce

**B. Tech**

- Chemical Engineering
- Computer Science and Information Technology
- Electrical Engineering
- Electronics & Communication Engineering
- Electronics & Instrumentation Engineering
- Mechanical Engineering

**M.Sc.**

- Physics
- Chemistry
- Mathematics
- Animal Science (Zoology)
- Plant Science (Botany)
- Micro Biology

**Professional PG Courses**

- M. Pharma (Pharmaceutical Chemistry)
- M. Pharma (Pharmacology)
- Mathematics
- M. Pharma (Pharmaceutics)
- M.Ed.
- M.B.A. (General)
- M.B.A. (Marketing)
- M.B.A. (Part Time)
- M.C.A.
- L.L.M
- M.S.W.
- M.R.D.M (Master of Rural Development & Management)

**U.G. Courses**

- B.Ed.
- B.H.M.C.T.
- B. Pharma

**P.G. Diploma**

- Advance P.G.D.C.A
- Mass Communication & Electronic Journalism
- P.G. Diploma in Women Empowerment and Development
- P.G. Diploma in Entrepreneurship Development