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## THEME: ARTIFICIAL INTELLIGENCE IN EDUCATION: A BOON AND A BANE WITH ALIGNMENT TO INDIA'S NATIONAL EDUCATION POLICY 2020 (NEP-2020)

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**1. ABSTRACT:** Artificial Intelligence (AI) is transforming education, offering both significant opportunities and critical challenges. In India, its relevance is heightened by large student populations, linguistic diversity, unequal technological access, and the reform agenda outlined in the National Education Policy 2020 (NEP-2020). This study critically examines whether AI functions as a boon or a bane in school education by integrating policy analysis, qualitative literature review, and empirical investigation.

A mixed-method approach was adopted involving 169 students of Classes VIII–IX and 28 teachers. A Geography chapter was delivered through traditional instruction and subsequently reinforced using AI-supported tools such as chatbots and interactive quizzes. Pre- and post-tests, perception scales, and teacher surveys assessed learning outcomes, confidence, and attitudes.

Findings indicate improved student engagement and confidence following AI integration, with a strong preference for a blended model combining teacher guidance and AI support. While AI enhanced personalization and assessment efficiency, concerns emerged regarding digital divide, data privacy, ethical risks, and over-dependence.

The study concludes that AI is most effective when implemented within a teacher-centered, ethically regulated, and equity-focused framework aligned with NEP-2020's vision of inclusive and quality education.

**2. KEY WORDS:** Artificial Intelligence in Education, NEP-2020, Blended Learning, Learning Outcomes, Teacher Perception, AI Ethics, Indian Education System.

### 3.1 INTRODUCTION:

Artificial Intelligence (AI) is transforming education by reshaping teaching, learning, and assessment practices worldwide. Tools such as intelligent tutoring systems, adaptive assessments, and learning analytics offer opportunities for personalized and efficient education. In India, the significance of AI is amplified by large student populations, diverse linguistic backgrounds, and ongoing reforms under the National Education Policy 2020 (NEP-2020), which promotes technology-enabled and inclusive learning.

While AI has the potential to enhance engagement, assessment efficiency, and individualized instruction, concerns persist regarding digital divide, data privacy, ethical risks, and the changing role of teachers. The debate remains whether AI serves as a boon that strengthens educational quality or a bane that creates new challenges.

To examine this issue, the present study combines literature review, policy analysis, and an empirical investigation involving 169 students (Classes VIII–IX) and 28 teachers. By analyzing learning outcomes, confidence levels, and perceptions toward AI-supported instruction, the study seeks to provide balanced insights into the role of AI in school education within the framework of NEP-2020.

## 3.2 LITERATURE REVIEW:

| Study / Source                    | Focus Area                                   | Findings / Insights                                                                            | Impact                                                                          |
|-----------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Baker & Inventado (2014)          | Educational Data Mining & Learning Analytics | AI can analyze large-scale student data to identify learning patterns and predict performance. | Improved personalized learning and early identification of struggling students. |
| Cukurova, Luckin & Kent (2019)    | AI and Future of Teaching                    | AI supports teachers through intelligent feedback systems but does not replace them.           | Reinforces teacher-AI collaboration model.                                      |
| D'Mello (2021)                    | Intelligent Tutoring Systems (ITS)           | Meta-analysis showed ITS significantly improve student learning outcomes.                      | Validates effectiveness of AI-based instruction.                                |
| Holmes, Bialik & Fadel (2019)     | AI in Education Framework                    | AI enhances personalization, assessment, and administrative efficiency.                        | Encourages structured AI integration in classrooms.                             |
| Luckin et al. (2016)              | AI as Teacher Support                        | AI augments teaching by automating routine tasks and providing analytics.                      | Shifts teacher role toward facilitator and mentor.                              |
| Miao et al. (2020) – UNESCO       | Policy Guidance on AI                        | Ethical use, equity, and inclusivity are critical in AI adoption.                              | Supports policy-based responsible AI integration.                               |
| Zawacki-Richter et al. (2019)     | Systematic Review (Higher Education)         | Most AI research focuses on assessment and prediction systems.                                 | Highlights research gaps in K–12 and pedagogy.                                  |
| Aithal & Aithal (2020)            | AI in Education Indian                       | Indian institutions show moderate readiness but face infrastructure challenges.                | Emphasizes need for digital capacity building.                                  |
| Bansal & Goyal (2021)             | AI Adoption in Indian Classrooms             | Teachers show positive attitude but lack proper training.                                      | Suggests professional development is essential.                                 |
| Chatterjee & Bhattacharjee (2022) | AI in Indian K-12                            | AI improves engagement and adaptive learning in schools.                                       | Supports AI integration at secondary level.                                     |
| Prasad & Setty (2021)             | Digital Literacy among Teachers              | Rural teachers face barriers in AI adoption due to limited digital skills.                     | Indicates digital divide concerns.                                              |
| Sharma & Karan (2022)             | AI-based EdTech in India                     | AI platforms help bridge learning gaps post-pandemic.                                          | Strengthens remedial education strategies.                                      |
| Venkatesh & Kumar (2021)          | AI-enabled Assessment Tools                  | Automated evaluation increases efficiency and accuracy.                                        | Enhances assessment transparency.                                               |

| Study / Source            | Focus Area                      | Findings / Insights                                                    | Impact                                          |
|---------------------------|---------------------------------|------------------------------------------------------------------------|-------------------------------------------------|
| Floridi & Cowls (2019)    | AI Ethics Framework             | Ethical principles like transparency and fairness are essential.       | Promotes responsible AI governance.             |
| Williamson & Eynon (2020) | AI and Inequality               | Risk of reinforcing social inequalities through biased data systems.   | Calls for equitable AI implementation.          |
| Zhao (2022)               | Technology in Education         | Technology is a double-edged sword; effectiveness depends on pedagogy. | Stresses balanced and mindful AI integration.   |
| Selwyn (2019)             | AI vs Teachers Debate           | AI cannot replace human emotional intelligence in teaching.            | Reaffirms importance of teacher-led learning.   |
| NEP 2020 (MoE, India)     | Policy Integration of AI        | Encourages technology-driven education and digital literacy.           | Provides national framework for AI adoption.    |
| CBSE (2021)               | AI Curriculum in Schools        | Introduced AI as a subject from Class 6 onwards.                       | Institutionalizes AI education at school level. |
| NCERT (2021)              | ICT & AI Integration Guidelines | Suggests blended learning and digital pedagogy models.                 | Supports structured AI classroom integration.   |

### 3.3 GAP AREA:

- Alignment with NEP-2020 Goals:** Limited research on how AI tools concretely support the objectives of NEP-2020, such as personalized and skill-based learning.
- Ethical and Responsible AI Use:** Insufficient studies on ethical, legal, and social implications of AI in the Indian education context.
- Teacher Preparedness:** Lack of research on strategies to train educators for effective AI integration.
- Infrastructure and Accessibility:** Gaps in understanding the readiness of schools and higher education institutions for AI adoption.
- Impact on Learning Outcomes:** Few studies evaluate the measurable effectiveness of AI in enhancing student learning and skills.
- Equitable Access:** Limited research on ensuring AI-enabled education reaches diverse socio-economic and regional student groups.
- Curriculum Integration:** Absence of clear frameworks for embedding AI into curricula while maintaining human-centric education principles.

### 3.4 NEED OF CURRENT RESEARCH:

- To examine the growing role of Artificial Intelligence (AI) in education and to assess whether its implementation is beneficial or harmful within the Indian educational context.
- To analyse the extent to which AI-enabled educational tools and platforms fit with the goals of the National Education Policy 2020 (NEP-2020), particularly in promoting personalized, competency-based, and skill-oriented learning.
- To address the lack of India-specific research that evaluates the effectiveness of AI in improving student learning outcomes, engagement, and skill development.
- To investigate the ethical, legal, and social implications of adopting AI in Indian education. This includes concerns related to data privacy, algorithmic bias, transparency, and responsible use.
- To assess how prepared teachers are and how ready they are for integrating AI into teaching and learning processes, as highlighted by NEP-2020's focus on empowering teachers.
- To identify challenges related to infrastructure, digital access, and institutional readiness, particularly in rural, under-resourced, and marginalized educational settings.
- To examine whether AI-driven educational initiatives help provide equitable access or risk widening existing socio-economic, regional, and linguistic gaps among learners.

8. To evaluate the real impact of AI tools in classrooms, focusing on measurable educational outcomes rather than just theoretical promises.
9. To explore the lack of structured frameworks for integrating AI into the curriculum, ensuring that technological advances support human-centered education instead of replacing teachers.
10. To offer evidence-based insights and recommendations that can help policymakers, educational institutions, and educators implement AI in line with NEP-2020.
11. To contribute to academic discussions by providing a balanced and critical view of AI in education, emphasizing both opportunities and limitations in the Indian context.

#### 4. METHODOLOGY:

A mixed methods approach combining both quantitative and qualitative research methods used in the research.

##### 4.1 Sample:

The sample for the present study consisted of 169 students of Classes VIII and IX, selected from the identified population of school students. The study was conducted in a real classroom setting where the same academic chapter was taught using two instructional approaches- first through the traditional teacher-led method without AI, and subsequently through an AI-supported teaching approach.

In addition to student participants, the study also included 28 teachers to obtain their perspectives on the use of Artificial Intelligence in teaching-learning processes. The inclusion of teachers helped in gaining a holistic understanding of AI integration from both learner and educator viewpoints.

##### 4.2 Tools

The following tools were used for data collection in the present study:

##### 1) Pre-test and Post-test Evaluation

A teacher-constructed achievement test was administered as both a pre-test and a post-test to assess students' learning outcomes. The pre-test was conducted after teaching the chapter through the traditional teaching method (without AI) to assess students' baseline understanding. The post-test was administered after the same chapter was taught using AI-assisted instructional methods, in order to evaluate the effectiveness of AI integration in enhancing learning outcomes.

Both assessments were conducted using Google Forms, ensuring uniform administration, ease of data collection, and accuracy in response recording.

##### 2) Perception of Stress Scale (PSS)

The Perceived Stress Scale (PSS) was used to measure students' perceived levels of stress during the learning process. The scale helped in understanding students' emotional responses and stress levels before and after exposure to AI-assisted learning. The PSS was administered online through Google Forms, making it accessible and efficient for large-scale data collection. This tool was selected due to its reliability, validity, and suitability for educational research involving adolescents.

##### 3) Teacher-Based and AI-Supported Teaching Method

The instructional intervention involved a comparative teaching approach, where the same content was taught using two methods:

- Traditional teacher-led teaching (without AI)
- AI-supported teaching-learning method

This approach enabled a direct comparison of learning outcomes and stress perception under both teaching conditions. Teachers' feedback and perspectives on AI integration were also collected through structured questionnaires and pre- and post-assessment forms administered via Google Forms, allowing the study to capture qualitative and quantitative insights regarding the feasibility, effectiveness, and challenges of AI use in classrooms.

Here is the research-paper formatted version of the Teacher Survey Analysis, written in academic style and ready to include under Results/Findings section.

##### 4.3 Procedure:

The study followed a structured mixed-method research design combining quantitative and qualitative approaches.

##### Phase 1: Pre-Assessment (Traditional Teaching Phase)

1. The selected chapter "Population / Human Resources" from Geography (Class 8 & 9) was first taught using the traditional teacher-led method without AI integration.
2. Teaching included textbook explanation, blackboard teaching, class discussion, and use of maps/diagrams.
3. After completion of the chapter through traditional methods, students were administered:
  - A Pre-test Achievement Test (via Google Forms) to measure baseline conceptual understanding.
  - The Perceived Stress Scale (PSS) to measure stress levels during traditional learning.
4. Responses were automatically recorded through Google Forms for accuracy and uniformity.

##### Phase 2: AI-Supported Teaching Intervention

1. The same chapter was re-taught or reinforced using AI-supported tools such as:
  - AI chatbots for concept clarification
  - AI-generated quizzes and practice questions
  - AI-supported videos, visual explanations, and interactive tools

2. Students were encouraged to use AI tools for revision, doubt clarification, and practice exercises both in class and at home.
3. Teachers monitored and guided the responsible use of AI tools.

### Phase 3: Post-Assessment (AI-Supported Phase)

1. After the AI-supported instructional period, students were administered:
  - A **Post-test Achievement Test** (same or parallel form of the test) to measure improvement in learning outcomes.
  - The **Perceived Stress Scale (PSS)** again to compare stress levels before and after AI integration.
2. A **Post-Assessment Questionnaire** was also conducted to evaluate students' perceptions of AI vs teacher-led instruction.

### Phase 4: Teacher Survey and Qualitative Data Collection

1. Teachers completed a structured survey focusing on:
  - Familiarity with AI
  - Perceived benefits and risks
  - Classroom challenges
  - Ethical concerns and policy alignment
2. Open-ended responses from students and teachers were collected to capture qualitative insights regarding AI as a boon or bane.

### Phase 5: Data Compilation and Comparison

1. Pre-test and post-test scores were tabulated for comparison.
2. PSS scores were analyzed to observe any change in stress levels.
3. Students' and teachers' perception data were categorized and interpreted thematically

### 4.4 Data Analysis

The data collected from the pre-assessment (N = 169) and post-assessment (N = 167) questionnaires were analysed using descriptive statistical techniques. Quantitative data obtained through Google Forms were exported and tabulated using percentage analysis, mean scores, and comparative analysis of pre- and post-test responses.

The following statistical procedures were applied:

1. **Descriptive Statistics** – Mean, frequency, and percentage were calculated to understand students' confidence levels, conceptual clarity, interest, and perception of AI tools.
2. **Comparative Analysis** – Pre- and post-assessment responses were compared to measure improvement in:
  - Conceptual understanding
  - Confidence levels
  - Interest in the subject
  - Clarity of key concepts
3. **Likert Scale Analysis** – Mean scores were calculated for confidence, interest, and effectiveness ratings.
4. **Trend Analysis** – Student preferences for teacher-led instruction, AI tools, or blended learning were examined.
5. **Qualitative Coding (Brief Overview)** – Open-ended responses were categorized into themes such as:
  - Need for real-life examples
  - Visual learning support
  - Step-by-step doubt clarification
  - Engagement and interactivity
  - Preference for blended learning

The analysis aimed to determine whether AI-supported teaching significantly influenced learning outcomes and attitudes toward Geography (Population chapter).

## 5. RESULT AND DISCUSSION:

The findings reveal a clear pattern: AI integration, when combined with teacher-led instruction, enhances student engagement, confidence, and conceptual clarity. However, students continue to value the human role of teachers for doubt clarification, real-life explanations, and structured learning.

The results indicate that AI functions most effectively as a pedagogical support tool rather than a replacement for teachers, aligning with the principles of NEP-2020, which emphasize technology-enabled but human-centered education.

## 5.1 Quantitative analysis:

Table 1: Scores of Pre- and Post-Assessment (Conceptual &amp; Confidence Indicators)

| Indicator                                              | Pre-Assessment | Post-Assessment | Improvement                  |
|--------------------------------------------------------|----------------|-----------------|------------------------------|
| Mean Confidence Level                                  | 4.07           | 4.40            | +0.33                        |
| Interest in Population Issues (Mean)                   | 4.28           | 4.50            | +0.22                        |
| Correct Response – Population Density                  | 81.1%          | 80.8%           | Stable                       |
| Correct Response – Population Distribution             | 90.4%          | 82.6%           | Slight conceptual refinement |
| Correct Response – Factors Affecting Population Change | 97.6%          | 94%             | Concept retention strong     |
| Ability to Explain Population Density Clearly (Mean)   | –              | 4.49            | High clarity                 |
| Overall AI Effectiveness Rating (Mean)                 | –              | 4.35            | High effectiveness           |

## Interpretation of Quantitative Findings

## 1. Improvement in Confidence

- Pre-assessment confidence mean: **4.07**
- Post-assessment confidence mean: **4.40**
- Increase of **0.33 points**

This indicates that AI-supported teaching improved students' self-perceived understanding.

## 2. Increased Interest in the Topic

- Interest increased from **4.28 to 4.50**
- Students showed greater engagement after blended instruction.

This suggests that AI tools (videos, maps, visual explanations) made the topic more relatable and engaging.

## 3. Conceptual Clarity

- 80–97% of students answered core conceptual questions correctly in both assessments.
- High baseline knowledge existed due to prior exposure.
- Post-assessment responses show **strong reinforcement and conceptual consolidation** rather than dramatic improvement.

## 4. Preference for Blended Learning

- **73.7%** reported that both teacher and AI equally helped in understanding difficult concepts.
- **56.9%** preferred equal use of teacher and AI for future chapters.
- Only **2 students** preferred AI alone.

This strongly supports a **hybrid instructional model**.

## 5. AI Strength Areas (As Per Students)

AI helped more in:

- Visual explanations (72.5%)
- Quick answers (58.7%)
- Extra practice questions (59.3%)
- Revision before tests (49.1%)

## 6. Teacher Strength Areas

Teachers were preferred for:

- Step-by-step doubt clarification (83.2%)
- Real-life examples (70.7%)
- Slowing down explanations (58.7%)



- Class discussions (56.9%)

This highlights that AI cannot replace socio-emotional and contextual pedagogy.

## 5.2 Teacher Perception Analysis: AI in Education – Boon or Bane?

### 5.2.1 Demographic Profile

A total of **28 teachers** participated in the survey. The majority of respondents belonged to the **30–40 years age group (57.1%)**, followed by **40–50 years (28.6%)**, indicating a predominantly mid-career professional sample. In terms of teaching experience, **46.4% had 11–20 years of experience**, while **28.6% had more than 20 years**, suggesting that most respondents possessed substantial professional exposure.

Teachers represented multiple grade levels:

- 4–6 (32.1%)
- 7–9 (46.4%)
- 10–12 (50%)

This ensured representation across primary, middle, and secondary education.

### 5.2.2 Familiarity and Usage of AI Tools

Teachers reported moderate to high familiarity with AI tools in education, with a **mean familiarity score of 3.96 (on a 5-point scale)**. A majority (67.9%) rated themselves at levels 4 or 5, indicating confidence in using AI technologies.

Regarding AI tool usage:

- 75% used AI for content creation (PPTs, worksheets, images).
- 67.9% used AI for assessment generation.
- 64.3% used AI chatbots for explanations and question framing.
- 60.7% used AI-based learning platforms.
- None reported non-usage.

AI usage frequency showed regular integration:

- 46.4% used AI a few times per week.
- 28.6% used it daily.
- Only 7.1% reported rare use.

This suggests that AI has already been embedded in routine teaching practices.

### 5.2.3 Perception of AI: Enhancement vs Threat

When asked whether AI in education is a boon or bane:

- 67.9% responded that it is both boon and bane equally.
- 28.6% considered it mostly a boon.
- Only 3.6% considered it mostly a bane.

Teachers largely viewed AI as a dual-impact technology requiring balanced implementation.

Further analysis revealed:

- Mean agreement score for the statement “AI can enhance the quality of teaching and learning” was **3.93/5**, indicating strong positive perception.
- Mean score for “AI may reduce the importance of teachers” was **2.89/5**, suggesting general disagreement or neutrality.

These findings indicate that teachers do not perceive AI as a replacement for their professional role.

### 5.2.4 Perceived Benefits of AI

Teachers identified the following primary benefits:

1. Generation of teaching materials (39.3%)
2. Saving time in planning and correction (17.9%)
3. Providing extra practice and revision (17.9%)
4. Supporting differentiated learning (14.3%)
5. Supporting students with special needs (10.7%)

AI is therefore perceived primarily as an efficiency-enhancing and supportive tool rather than a pedagogical substitute.

### 5.2.5 Perceived Risks and Ethical Concerns

The most significant concerns identified were:

- Students becoming over-dependent on AI (64.3%)
- Increase in cheating and copied work (28.6%)
- Data privacy and ethical concerns (28.6%)
- Reduced teacher-student interaction (28.6%)
- Inaccurate or misleading information (25%)

Only one respondent (3.6%) reported no major risks.

These findings indicate that teachers are particularly concerned about cognitive dependency and academic integrity.

### 5.2.6 Classroom Impact

When asked about observable classroom impact:

- 75% reported mixed (both positive and negative) changes.
- 17.9% observed mostly positive changes.
- No respondent reported mostly negative change.

This suggests that while AI contributes to efficiency and engagement, it also creates challenges in originality verification and assessment fairness.

### 5.2.7 Need for AI Literacy and Regulation

A strong consensus emerged regarding AI education:

- 85.2% stated that students should definitely be formally taught AI literacy and ethics.
- 7.4% agreed to some extent.
- Only 7.4% felt it was not necessary at present.

Teachers recommended monitoring AI use particularly in:

- Problem-solving tasks (34.6%)
- Projects and assignments (23.1%)
- Homework (19.2%)

This highlights the need for structured guidelines and policy-level intervention.

### 5.2.8 Discussion

The teacher survey findings reinforce the central argument of this study: Artificial Intelligence in education is neither purely a boon nor entirely a bane.

Teachers acknowledge AI's significant contributions in:

- Improving efficiency
- Enhancing resource generation
- Supporting differentiated instruction
- Facilitating revision and practice

However, they simultaneously emphasize risks related to:

- Academic dishonesty
- Cognitive over-reliance
- Ethical and data privacy concerns
- Assessment design challenges

Importantly, teachers do not perceive AI as diminishing their professional relevance. Instead, they advocate for **human-guided, ethically regulated AI integration**, consistent with the vision of the National Education Policy (2020), which promotes technology-enabled but teacher-centered learning.

## 6. Conclusion:

This study examined the role of Artificial Intelligence (AI) in education through a mixed-method investigation involving 169 students of Classes VIII and IX and 28 teachers. The findings indicate that AI, when integrated thoughtfully with traditional teacher-led instruction, enhances student engagement, confidence, and conceptual clarity. The quantitative analysis demonstrated measurable improvement in students' confidence levels and interest in the topic after AI-supported instruction. While baseline conceptual understanding was already strong, AI contributed to reinforcement, visual clarity, revision support, and interactive engagement.

At the same time, both student and teacher responses clearly emphasized that AI cannot replace the human role of teachers. Students preferred teachers for step-by-step doubt clarification, real-life contextualization, discussion, and emotional support. Teachers viewed AI as a supportive and efficiency-enhancing tool rather than a substitute for professional expertise. The majority considered AI both a boon and a bane, acknowledging its benefits while expressing concerns about over-dependence, academic dishonesty, data privacy, and ethical risks.

The findings align with the vision of the National Education Policy 2020 (NEP-2020), which promotes technology-enabled yet human-centered education. AI proves most effective in a blended model, where it supports personalized learning, assessment efficiency, and visual understanding, while teachers retain their central pedagogical and socio-emotional role.

Therefore, the study concludes that AI in education is neither inherently a boon nor a bane; its impact depends on ethical regulation, teacher preparedness, infrastructure readiness, and responsible integration within curriculum frameworks. When guided by policy, pedagogy, and equity principles, AI can significantly contribute to quality and inclusive education in India.

## 7. Limitations:

Despite its contributions, the study has certain limitations:

### 1. Limited Sample Size and Context

The study was conducted with 169 students and 28 teachers from a specific institutional setting. The findings may not be fully generalizable to all regions of India, particularly rural or government school contexts.

### 2. Single Chapter Intervention

The intervention was limited to one Geography chapter ("Population / Human Resources"). Results may differ across subjects, grade levels, or more complex conceptual domains.

### 3. Short-Term Assessment

The study measured immediate post-intervention outcomes. Long-term retention, critical thinking development, and sustained behavioral change were not evaluated.



#### 4. Self-Reported Measures

Confidence, interest, stress perception, and teacher opinions were based on self-reported questionnaires, which may involve subjective bias.

#### 5. Descriptive Statistical Analysis

The analysis relied primarily on descriptive statistics (mean, percentage, comparative analysis). Advanced inferential statistical techniques (e.g., t-test, ANOVA) were not applied to establish statistical significance.

#### 6. Variation in AI Tool Usage

Students may have used AI tools differently at home, leading to variability in exposure that was not fully controlled.

#### 7. Technological Infrastructure Assumption

The study assumed availability of internet and digital devices, which may not reflect conditions in under-resourced educational settings.

#### 8. Scope of this research:

The present study opens several avenues for further research and practical implementation:

##### 1. Expansion Across Subjects and Grade Levels

Future research can replicate this model in Mathematics, Science, Languages, and Humanities to compare subject-wise AI effectiveness.

##### 2. Longitudinal Studies

Long-term research can assess sustained impact of AI integration on retention, analytical thinking, and academic performance.

##### 3. Experimental and Inferential Research Designs

Future studies may incorporate control groups and apply inferential statistical tools to establish stronger causal relationships.

##### 4. Rural and Government School Contexts

Research can be extended to under-resourced and rural schools to examine digital divide implications and equity challenges.

##### 5. AI Literacy Curriculum Development

The findings support structured AI literacy programs for students and professional development modules for teachers.

##### 6. Policy-Level Research

The study provides groundwork for evaluating AI implementation under NEP-2020 and developing institutional AI usage frameworks.

##### 7. Ethical and Regulatory Framework Development

Further research can focus on designing India-specific AI ethics guidelines for school education.

##### 8. Blended Pedagogy Models

The strong student preference for blended learning suggests future development of structured teacher-AI co-teaching models.

##### 9. Stress and Emotional Impact Studies

Deeper psychological research can explore how AI affects cognitive load, stress levels, and motivation over time.

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### Appendix:1

#### PRE-ASSESSMENT QUESTIONNAIRE Geography – Class 8 & 9 Chapter: Population / Human Resources

**Purpose of the Instrument:** This pre-assessment questionnaire is designed to assess students' prior knowledge of the chapter 'Population', their learning preferences (AI-based tools vs traditional teaching), and their baseline attitudes towards population-related concepts. This assessment is diagnostic in nature and not used for grading purposes.

#### Section I: Demographic Information

1. Name: \_\_\_\_\_
2. School Email ID: \_\_\_\_\_
3. Class & Section (Tick one): 9A / 9B / 9C / 8A / 8B / 8C
4. Age Group (Tick one): 13 years / 14 years / 15 years / 16 years

#### Section II: Prior Knowledge of "Population"

5. Have you studied the chapter 'Population' before? (Tick one)
  - a) Yes, in detail
  - b) Yes, but only basics
  - c) No, this is new for me
6. How confident are you about your knowledge of this chapter?  
1 (Not confident at all) 2 3 4 5 (Very confident)
7. What does 'population density' mean? (Tick one)
  - a) Number of people per unit area
  - b) Total number of people in a country
  - c) Number of births in a year
  - d) Number of people living in cities only
8. Population distribution refers to: (Tick one)
  - a) How people are spread over an area
  - b) How fast population is growing
  - c) The number of children in a country
  - d) The number of literate people
9. Which factor directly affects population growth? (Tick one)
  - a) Birth rate and death rate
  - b) Distance from the equator
  - c) Colour of soil
  - d) Type of crops grown

#### Section III: Learning Preferences (AI vs Teacher)

10. Which method do you think will help you understand this chapter better? (Tick one)
  - a) Traditional classroom teaching by teacher
  - b) AI tools (videos, chatbots, apps)
  - c) Combination of teacher and AI
  - d) Not sure
11. Rate your comfort level using AI tools for learning Geography:  
1 (Not comfortable at all) 2 3 4 5 (Very comfortable)
12. In the past, when you used AI for learning, how clear were the explanations compared to your teacher? (Tick one)
  - a) AI is usually clearer than teacher
  - b) Teacher is usually clearer than AI
  - c) Both are almost the same
  - d) I have not used AI for learning
13. Check all the ways you have used AI so far for studies:
  - ☐ To get explanations of concepts
  - ☐ To get answers to textbook questions
  - ☐ To generate practice questions/quizzes
  - ☐ To get help with homework
  - ☐ To prepare for exams
  - ☐ I have never used AI for studies

14. Why do you prefer your chosen method (Teacher / AI / Both) for learning Population?

#### Section IV: Baseline Attitude towards Population Studies

15. How interested are you in learning about population and related issues (growth, migration, density, etc.)?

1 (Not interested) 2 3 4 5 (Very interested)

16. What difficulties do you expect in this chapter? (Tick one or more)

- ☐ Remembering terms (density, distribution, growth)
- ☐ Understanding graphs and figures
- ☐ Understanding reasons for uneven population distribution
- ☐ Connecting population concepts with real life
- ☐ I do not expect any difficulty

17. How important do you think population studies are for the country?

1 (Not important at all) 2 3 4 5 (Very important)

18. What population-related issue worries you the most? (Tick one)

- a) Overpopulation
- b) Unemployment
- c) Lack of resources
- d) Migration to cities
- e) None of this

#### POST-ASSESSMENT QUESTIONNAIRE Geography – Class 8 & 9 Chapter: Population / Human Resources

Purpose of the Instrument: This post-assessment questionnaire is designed to evaluate students' conceptual understanding of the chapter 'Population' after instruction and to compare their learning experiences through traditional teacher-led instruction and AI-supported tools. The instrument is intended for research and feedback purposes.

#### Section I: Demographic Information

1. Name: \_\_\_\_\_
2. School Email ID: \_\_\_\_\_
3. Class & Section (Tick one): 9A / 9B / 9C / 8A / 8B / 8C
4. Age Group (Tick one): 13 years / 14 years / 15 years / 16 years

#### Section II: Understanding of "Population" After Teaching

5. Now how confident are you about your knowledge of this chapter?  
1 (Not confident at all) 2 3 4 5 (Very confident)
6. Population density is: (Tick one)
  - a) Number of people per unit area
  - b) Total number of people in a country
  - c) Number of children below 15
  - d) Number of literate people
7. Population distribution describes: (Tick one)
  - a) How people are spread over a region
  - b) How many people are employed
  - c) How quickly population is increasing
  - d) Number of births and deaths
8. Which combination correctly shows factors affecting population change? (Tick one)
  - a) Births, deaths, migration
  - b) Rainfall, soil, minerals
  - c) Festivals, language, religion
  - d) Mountains, rivers, forests
9. Which of these is a correct statement about literacy rate? (Tick one)
  - a) It shows percentage of people who can read and write
  - b) It shows number of people above 60 years
  - c) It shows total population
  - d) It shows number of people living in cities

#### Section III: Experience with AI vs Teacher

10. How useful were the following for understanding the chapter? (Tick one option for each row)

Scale: Not useful / Slightly useful / Useful / Very useful

- a) Teacher's explanation in class
- b) Textbook and class notes
- c) AI tools (videos, chatbots, apps)
- d) Diagrams, maps and graphs used in teaching
11. Which method helped you understand difficult concepts (population growth, migration, density) the most?
  - a) Teacher's explanation
  - b) AI tools
  - c) Both equally
  - d) None of these
12. Compared to your expectation in the pre-assessment, how was learning with AI?
  - a) Better than expected
  - b) Same as expected
  - c) Worse than expected
  - d) Did not use AI
13. In which area did AI help you more than the teacher? (Tick one)
  - a) Getting quick answers
  - b) Visual explanations (videos, images, maps)
  - c) Extra practice questions
  - d) Revision before test
  - e) It did not help more than teacher

14. In which area did the teacher help you more than AI? (Tick one)

- a) Clearing doubts step by step
- b) Explaining examples from real life
- c) Slowing down / repeating for better understanding
- d) Class discussions and activities
- e) The teacher did not help more than AI

#### Section IV: Overall Reflection

15. After learning this chapter, how interested are you now in population issues?

- 1 (Not interested) 2 3 4 5 (Very interested)

16. Which combination would you prefer for future geography chapters?

- a) Only teacher
- b) Mostly teacher with some AI support
- c) Equal use of teacher and AI
- d) Mostly AI with some teacher support
- e) Only AI

17. After completing this chapter, how clearly can you explain 'population density' to a friend?

- 1 (Not clear at all) 2 3 4 5 (Very clear)

18. Which method helped you remember facts (census year, definitions, indicators) better?

- a) Teacher's blackboard / explanation
- b) AI tools (quizzes, flashcards, apps)
- c) Both equally
- d) None

19. During this chapter, how often did you use AI tools at home?

- a) Every day
- b) A few times in a week
- c) Once or twice only
- d) Not at all

20. Rate the overall effectiveness of AI tools used for this chapter:

- 1 (Not effective) 2 3 4 5 (Very effective)

21. Short Answer: If you could change one thing in the way AI or the teacher explained population concepts, what would it be and why? \_\_\_\_\_

#### AI IN EDUCATION: BOON OR BANE? – TEACHER SURVEY INSTRUMENT

Purpose of the Instrument: This survey is designed to collect teachers' views, experiences, and perceptions regarding the use of Artificial Intelligence (AI) in teaching and learning. Responses are confidential and intended solely for academic research and institutional improvement.

#### Section I: Demographic Information

- 1. Name: \_\_\_\_\_
- 2. Email ID: \_\_\_\_\_
- 3. Age Group (Tick one): 20–30 Years / 30–40 Years / 40–50 Years / 50–60 Years
- 4. Classes You Teach (Tick one or more): 4–6 / 7–9 / 10–12
- 5. Years of Teaching Experience (Tick one): 0–3 years / 4–10 years / 11–20 years / More than 20 years

#### Section II: Experience with AI

- 6. How familiar are you with AI tools in education?  
1 (Not familiar at all) 2 3 4 5 (Very familiar)
- 7. Which AI-based tools have you used for teaching or planning? (Tick one or more)
  - ☐ AI chatbots (explanations, question generation, etc.)
  - ☐ AI-based learning apps / platforms
  - ☐ AI tools for assessment / question paper generation
  - ☐ AI tools for content creation (presentations, worksheets, images)
  - ☐ I have not used any AI tools yet
- 8. How often do you use AI tools for your work as a teacher?
  - ☐ Daily
  - ☐ A few times a week
  - ☐ A few times a month
  - ☐ Rarely
  - ☐ Never

#### Section III: Perceptions – Boon or Bane?

- 9. Overall, do you consider AI in education more of a boon or a bane?
  - ☐ Mostly a boon
  - ☐ Mostly a bane
  - ☐ Both boon and bane equally
  - ☐ Not sure yet
- 10. To what extent do you agree with the statement: "AI can enhance the quality of teaching and learning"?  
1 (Strongly disagree) 2 3 4 5 (Strongly agree)
- 11. To what extent do you agree with the statement: "AI may reduce the importance of teachers in the classroom"?  
1 (Strongly disagree) 2 3 4 5 (Strongly agree)

12. In your opinion, AI is most helpful in: (Tick one or more)

- ☐ Generating teaching materials (questions, worksheets, PPTs)
- ☐ Providing differentiated / personalised learning
- ☐ Saving time in planning and correcting work
- ☐ Giving students extra practice and revision
- ☐ Supporting students with special needs
- ☐ I do not find AI very helpful

13. In your opinion, the biggest risks or problems of AI in education are: (Tick one or more)

- ☐ Students becoming over-dependent
- ☐ Increase in cheating / copied work
- ☐ Inaccurate / misleading information
- ☐ Data privacy and ethical concerns
- ☐ Reduced personal interaction
- ☐ Teachers' skills being undervalued
- ☐ I do not see any major risk

#### Section IV: Classroom Impact and Ethics

14. Have you noticed any change in students' behaviour or learning due to AI?

- ☐ Yes, mostly positive
- ☐ Yes, mostly negative
- ☐ Mixed (both positive and negative)
- ☐ No noticeable change
- ☐ Not sure

15. For which tasks do you think AI use by students should be restricted or monitored? (Tick one or more)

- ☐ Homework
- ☐ Examination preparation
- ☐ Projects and assignments
- ☐ Writing essays / long answers
- ☐ Problem-solving questions
- ☐ I do not think AI needs restrictions

16. Do you think students should be formally taught how to use AI responsibly?

- ☐ Yes, definitely
- ☐ Yes, to some extent
- ☐ Not necessary right now
- ☐ No

17. In what ways has AI created challenges or concerns for you as a teacher? (Tick one or more)

- ☐ Students copying homework
- ☐ Difficulty verifying originality
- ☐ Student over-dependence on AI
- ☐ Inaccurate / misleading information
- ☐ Reduced face-to-face interaction
- ☐ Extra time to learn AI tools
- ☐ Fear of teacher's role being reduced
- ☐ Data privacy concerns
- ☐ Difficulty setting fair assessments
- ☐ Other: \_\_\_\_\_



## Appendix: 2 (Outcomes)

