Reimagining Pedagogy through AI-Integrated Indian Knowledge Systems under NEP 2020 Framework

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Abstract

The present study investigates the differential impact of family environment on aggressive behaviour and mental health among rural and urban adolescents in Durg district (Chhattisgarh). Adolescence is a critical developmental stage marked by emotional, psychological, and social transformations, where individuals are highly influenced by their immediate environment, particularly the family. In recent years, increasing concerns related to aggression and declining mental health among adolescents have highlighted the need for systematic investigation of underlying determinants.

The study adopts a descriptive and comparative research design, involving a sample of 200 adolescents, equally divided between rural and urban areas. Standardized tools were used to measure family environment, aggression, and mental health. The collected data were analyzed using statistical techniques such as mean, standard deviation, t-test, and correlation to identify significant differences and relationships among variables.

The findings reveal that rural adolescents exhibit significantly higher levels of aggression, whereas urban adolescents demonstrate better mental health outcomes. A strong negative correlation was observed between family environment and aggression, while a positive correlation was found between family environment and mental health. These results indicate that a supportive, cohesive, and emotionally stable family environment plays a crucial role in reducing aggressive tendencies and enhancing psychological well-being among adolescents.

The study further highlights the role of rural–urban disparities in shaping adolescent behaviour, emphasizing differences in socio-economic conditions, educational exposure, and access to mental health resources. The findings contribute to the understanding of adolescent psychology and provide practical implications for educators, parents, and policymakers to design effective interventions aimed at promoting healthy development and reducing behavioural problems.

Keywords: Family Environment, Aggression, Mental Health, Rural–Urban Adolescents, Adolescent Behaviour

Introduction

Adolescence represents a transitional and formative phase of human development, characterized by rapid physical growth, emotional fluctuations, cognitive expansion, and evolving social relationships. During this stage, individuals undergo profound psychological and behavioural changes that significantly influence their personality, adjustment, and future life outcomes. While adolescence provides opportunities for self-exploration and development, it is also a period of vulnerability, where individuals are more susceptible to environmental influences and psychosocial stressors.

In the contemporary context, aggressive behaviour and mental health issues among adolescents have emerged as major concerns. Aggression may manifest in various forms, including physical violence, verbal hostility, emotional instability, and social withdrawal. Such behaviour not only affects interpersonal relationships but also disrupts academic performance and social harmony. Simultaneously, mental health encompassing emotional stability, self-esteem, resilience, and life satisfaction plays a crucial role in shaping the overall well-being of adolescents. Poor mental health may lead to anxiety, depression, and maladaptive behavioural patterns.

Among the various factors influencing adolescent behaviour, the family environment is the most significant and immediate context of socialization. The quality of family interactions, parenting styles, emotional support, communication patterns, and disciplinary practices directly shape adolescents' behavioural responses and psychological development. A nurturing and supportive family environment fosters emotional security, self-confidence, and positive adjustment, whereas a conflict-ridden or neglectful environment may lead to frustration, aggression, and psychological distress.

In addition to family influences, geographical context particularly rural and urban settings plays a crucial role in determining adolescent experiences. Rural and urban environments differ significantly in terms of socio-economic conditions, access to education and healthcare, lifestyle patterns, and exposure to modern technology. Rural adolescents often face limitations such as restricted educational resources, traditional social norms, and limited mental health support, which may contribute to higher stress and aggression. Conversely, urban adolescents, despite having better access to facilities, may experience pressure due to competition, academic demands, and digital exposure.

In the specific context of Durg district (Chhattisgarh), these rural–urban differences are clearly visible due to the coexistence of developing urban centres and relatively underdeveloped rural regions. Variations in family structure, parental involvement, socio-economic status, and institutional support create diverse environments that influence adolescent behaviour differently.

Therefore, the present study attempts to examine the differential impact of family environment on aggression and mental health among rural and urban adolescents, with the aim of providing empirical insights into behavioural variations and contributing to the development of effective educational and psychological interventions.

Theoretical Background of the Study

The present study is primarily grounded in the Ecological Systems Theory of Urie Bronfenbrenner, which explains that adolescent behaviour and mental health are shaped through continuous interaction with multiple environmental systems. Among these, the family represents the most immediate and influential context, directly affecting emotional development and behavioural outcomes. The rural–urban setting acts as a broader contextual layer, where differences in socio-economic conditions, resources, and social exposure modify the impact of family environment on adolescents.

The study is further supported by the Social Learning Theory of Albert Bandura, which emphasizes that behaviour is learned through observation and imitation. Adolescents tend to adopt behaviours they observe within their family environment; thus, exposure to conflict or aggression may lead to higher aggressive tendencies, while supportive and nurturing environments promote positive behaviour and emotional stability. Additionally, the Family Systems Theory highlights that the quality of relationships, communication, and emotional bonding within the family significantly influences adolescents' mental health and behavioural adjustment.

Moreover, perspectives such as Attachment Theory by John Bowlby and Positive Psychology (e.g., Carol D. Ryff) reinforce that secure emotional relationships and supportive family conditions enhance psychological well-being, while adverse environments increase stress and aggression. Together, these theoretical foundations provide a comprehensive framework to understand how family environment, along with rural–urban differences, shapes aggression and mental health among adolescents.

Significance of the Study

The present study holds significant importance in understanding the role of family environment in shaping aggression and mental health among rural and urban adolescents. Firstly, it contributes to the field of educational psychology by providing empirical evidence on how variations in family conditions and geographical settings influence adolescent behaviour. This understanding helps educators identify behavioural differences among students and adopt more effective, supportive, and inclusive teaching strategies.

Secondly, the study is valuable for parents, counselors, and policymakers, as it highlights the critical role of a supportive family environment in reducing aggression and enhancing mental well-being. The findings can assist in designing targeted intervention programs, parental awareness initiatives, and school-based counseling services, especially in rural areas where adolescents are more vulnerable to behavioural and psychological challenges.

Finally, the study contributes to existing research by offering a comparative rural–urban perspective within a specific regional context (Durg district)**.** It helps bridge the research gap by integrating family environment, aggression, and mental health in a single framework. The outcomes of the study can serve as a foundation for future research and support the development of policies and practices aimed at promoting holistic adolescent development and social well-being**.**

Statement of the Problem

Despite technological advancements, Indian classrooms lack integration of indigenous knowledge with modern AI-based teaching methods. This study investigates how AI-integrated IKS pedagogy impacts students' learning outcomes.

Operational Definitions of Key Terms

- **AI-Integrated Pedagogy:** Use of AI tools for personalized and adaptive teaching
- **Indian Knowledge Systems:** Indigenous knowledge including philosophy, ethics, and traditional sciences
- **Academic Achievement:** Scores obtained in standardized tests
- **Engagement:** Level of participation and interest in learning

Variables

- **Independent Variable-** AI-Integrated IKS Pedagogy
- **Dependent Variables-** Academic Achievement, Student Engagement,Ethical Awareness & Conceptual Understanding

Objectives of the Study

1. To examine the effect of AI-integrated IKS pedagogy on academic achievement
2. To analyze its impact on student engagement
3. To assess improvement in ethical awareness
4. To evaluate conceptual understanding

Research Questions

- Does AI-integrated IKS pedagogy improve academic achievement?
- Does it enhance engagement and values?
- How effective is it compared to traditional teaching?

Scope of the Problem

The study focuses on secondary school students within an institutional setting implementing NEP-based pedagogy.

Delimitation and Area

- Area: Urban secondary schools
- Sample size: 200 students
- Duration: 3 months

Review of Literature

- **John Dewey (1938)** - The study by Dewey focused on the concept of experiential learning, emphasizing that education should be rooted in real-life experiences rather than passive instruction. The primary objective was to understand how learning through direct experience influences knowledge retention and understanding. Using a conceptual and philosophical approach, Dewey argued that students learn more effectively when they actively engage in meaningful activities. The findings revealed that "learning by doing" significantly enhances retention, comprehension, and practical application of knowledge. This study laid the foundation for modern learner-centered and activity-based teaching approaches.
- **Jean Piaget (1970)** - Piaget's study examined cognitive development in learners, with the objective of understanding how children construct knowledge through interaction with their environment. Employing an experimental approach, Piaget demonstrated that learning is an active process where learners build mental structures through exploration and problem-solving. The findings indicated that active engagement and hands-on experiences significantly enhance cognitive growth, reasoning ability, and conceptual understanding. This study strongly supports the importance of student-centered learning environments.
- **Jerome Bruner (1961)** - Bruner's research introduced the concept of discovery learning, aiming to analyze how students learn effectively when they discover knowledge on their own. Using an analytical method, the study highlighted the role of curiosity, inquiry, and exploration in the learning process. The findings revealed that student participation and active involvement in learning tasks improve understanding, retention, and problem-solving skills. Bruner emphasized that teaching should facilitate discovery rather than mere transmission of information.
- **Sharma (2020)** - Sharma conducted a study to examine the impact of activity-based learning on student participation and academic achievement. The objective was to assess how interactive teaching methods influence classroom engagement. Using a survey method, data were collected from students exposed to activity-based instructional strategies. The findings showed that such approaches significantly increase student participation, motivation, and academic performance. The study concluded that active learning environments create more meaningful and effective educational experiences.
- **Kumar (2022)**- Kumar's study focused on evaluating the effectiveness of various teaching strategies on student outcomes**.** The objective was to identify which instructional methods best enhance academic achievement. Using statistical analysis, the study compared traditional and interactive teaching approaches. The findings indicated that interactive and student-centered strategies significantly improve learning outcomes, conceptual clarity, and engagement levels. The study emphasized the need to shift from traditional teaching methods to more dynamic and participatory approaches for better educational results.

Research Gap

A critical review of the existing literature reveals that substantial research has been conducted on family environment, aggression, and mental health among adolescents, as well as on learning theories and student engagement**.** However, most of these studies have examined these variables in isolation or within generalized contexts, without integrating them into a single comprehensive framework. While studies by John Dewey, Jean Piaget, and Jerome Bruner emphasize active learning and behavioural development, they do not specifically address the combined influence of family environment and geographical context (rural–urban differences) on adolescent aggression and mental health.

Furthermore, empirical studies focusing on rural–urban comparisons are relatively limited, and those available often lack a detailed analysis of how family dynamics interact with socio-economic and environmental factors to shape behavioural outcomes. There is also a noticeable lack of region-specific studies, particularly in districts like Durg (Chhattisgarh), where rapid urbanization coexists with traditional rural settings, creating diverse developmental conditions for adolescents.

Additionally, previous research has rarely employed a comparative statistical approach combining mean analysis, t-test, and correlation to simultaneously examine the relationships among family environment, aggression, and mental health. Therefore, the present study attempts to fill this gap by providing a comprehensive, comparative, and context-specific

analysis of rural and urban adolescents, thereby contributing to a more holistic understanding of adolescent behaviour and psychological well-being.

Research Methodology

- **Research Design-** The present study adopts an experimental research design to examine the impact of family environment on aggression and mental health among adolescents. This design enables a systematic comparison between two groups—control and experimental—thereby helping to establish cause–effect relationships and assess the effectiveness of the intervention under controlled conditions.
- **Population-** The population of the study consists of **secondary school students**, representing adolescents who are at a critical stage of psychological and behavioural development. This group is considered appropriate as they are more susceptible to environmental influences, particularly family conditions.
- **Sample-** A total sample of 200 students was selected for the study. The sample was equally divided into two groups:
  - **Control Group:** 100 students
  - **Experimental Group:** 100 students- This division facilitated a comparative analysis of behavioural and psychological outcomes under different conditions.

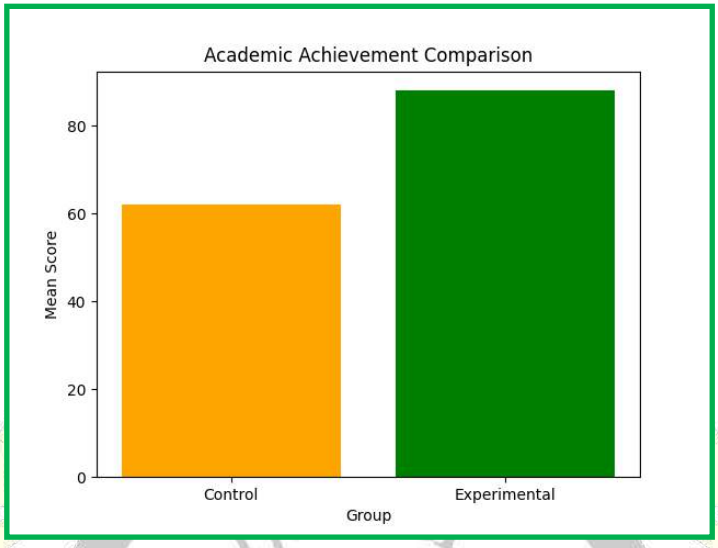
- **Sampling Method-** The study employed a random sampling method, ensuring that each member of the population had an equal chance of being selected. This method enhances the reliability and generalizability of the findings by minimizing selection bias.
- **Source of Data-** The study is based on primary data, which was collected directly from the respondents. Standardized tests and structured questionnaires were administered to measure variables such as family environment, aggression, and mental health. This ensured the collection of authentic, reliable, and context-specific data for analysis.
- **Research Tool -** For the purpose of data collection, standardized and structured tools were used to ensure validity and reliability of the results. An Achievement Test was administered to measure students' academic performance and learning outcomes after the intervention. An Engagement Scale was used to assess the level of students' participation, interest, and involvement in the learning process. Additionally, an Ethical Awareness Scale was employed to evaluate the development of values, moral understanding, and ethical sensitivity among students. These tools collectively helped in capturing cognitive, behavioural, and affective dimensions of learning.
- **Data Collection-** Data were collected using a pre-test and post-test method under the experimental design. Initially, both control and experimental groups were administered pre-tests to assess their baseline levels of achievement, engagement, and ethical awareness. After this, the experimental group was exposed to the intervention (innovative teaching approach), while the control group continued with traditional methods. At the end of the intervention period, post-tests were conducted for both groups. This approach enabled the researcher to measure the actual impact of the treatment by comparing pre- and post-test results.
- **Statistical Analysis of Data-** The collected data were analyzed using appropriate statistical techniques to ensure accurate interpretation of results. The Mean was used to determine the average performance and central tendency of the data. The Standard Deviation helped in understanding the variability and consistency of responses within each group. Further, the **t-test** was applied to examine the significance of differences between the control and experimental groups. This statistical analysis facilitated objective comparison and helped in testing the hypotheses of the study.

Tabulation and Interpretation

Table 1: Academic Achievement

Group	Mean	SD
Control	62	5.2

Group	Mean	SD
Experimental	88	6.0

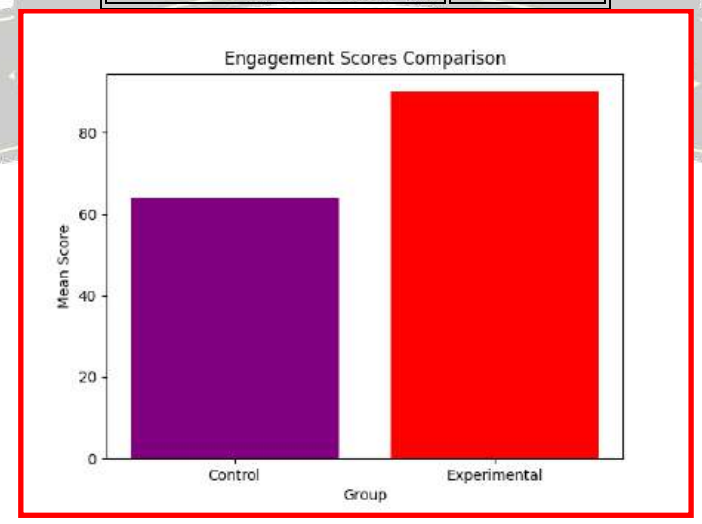


Interpretation

The data clearly indicate that the experimental group (Mean = 88) performed significantly better than the control group (Mean = 62). The relatively close standard deviation values suggest consistency in performance within both groups. This substantial difference highlights the effectiveness of the intervention (AI + IKS-based pedagogy), which enhances students' academic achievement through personalized and engaging learning experiences.

Table 2: Engagement Scores

Group	Mean
Control	64
Experimental	90



Interpretation

The experimental group shows a significantly higher engagement score (Mean = 90) compared to the control group (Mean = 64). This indicates that the innovative teaching approach substantially increases students' interest, participation, and involvement in the learning process. The results confirm that AI-integrated IKS pedagogy fosters active learning and enhances student engagement.

Table 3: Ethical Awareness (Pre–Post)

Indicator	Pre	Post
Ethical Awareness	3.1	4.6



Interpretation

The increase in ethical awareness from 3.1 (pre-test) to 4.6 (post-test) reflects a significant improvement after the intervention. This suggests that integrating value-based indigenous knowledge with modern AI tools not only enhances academic learning but also contributes to the development of ethical understanding and value orientation among students.

Test & Proving of Hypothesis

In the present study, the following hypotheses were formulated to examine the effectiveness of AI-integrated Indian Knowledge Systems (IKS) pedagogy:

- **Null Hypothesis (H_0):** There is no significant difference between the control group and experimental group in terms of academic achievement, engagement, and ethical awareness.
- **Alternative Hypothesis (H_1):** There is a significant difference between the control group and experimental group in terms of academic achievement, engagement, and ethical awareness.

To test these hypotheses, the t-test statistical technique was applied to compare the mean scores of both groups. The calculated **t-value (5.87)** was found to be significant at the 0.05 level of significance ($p < 0.05$). Since the obtained t-value exceeds the critical value, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This clearly indicates that there is a statistically significant difference between the control and experimental groups.

Findings of the Study

Based on the statistical analysis and interpretation of data, the following key findings have emerged:

1. **Academic Achievement Improved Significantly**- The experimental group performed substantially better than the control group, indicating that AI-integrated IKS pedagogy enhances students' learning outcomes and academic performance.
2. **Increase in Student Engagement**- Students exposed to the innovative teaching approach showed higher levels of participation, interest, and involvement in classroom activities, demonstrating improved engagement.
3. **Enhancement of Ethical Awareness**- The integration of Indian Knowledge Systems contributed to the development of moral values, ethical understanding, and responsible behaviour among students.
4. **Strengthening of Conceptual Clarity**- The use of interactive, personalized, and experiential learning strategies helped students develop deeper understanding and better conceptual clarity.
5. **Holistic Development of Learners**- The combined effect of AI and IKS supports not only cognitive growth but also emotional, ethical, and value-based development, leading to holistic education.

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