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Hoping all of you shall enjoy our endeavors and those of our contributors.

Editor



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On Certain Diophantine Equations Involving Prime Numbers and Their Distribution

Dr. Suresh Kumar*

Abstract:

The study of Diophantine equations occupies a central position in number theory due to its deep connections with prime numbers, algebraic structures, and arithmetic geometry. This paper investigates a class of Diophantine equations involving prime variables and explores how the distribution of prime numbers influences the existence and nature of their solutions. Using classical results such as the Prime Number Theorem, properties of linear and exponential Diophantine equations, and elementary analytic techniques, we establish sufficient conditions for the solvability of certain prime-based equations. New observations concerning the finiteness of solutions in specific cases are presented, contributing to the broader understanding of the interaction between Diophantine problems and prime distributions.

Keywords: Number Theory, Prime Numbers, Diophantine Equations, Prime Distribution, Arithmetic Functions.

1. Introduction

Number theory is one of the oldest and most profound branches of mathematics, concerned primarily with the arithmetic properties of integers. Among its central objects of study are prime numbers and Diophantine equations, both of which have played a foundational role in the development of mathematical thought from ancient times to the modern era. Primes serve as the fundamental building blocks of the integers, while Diophantine equations represent the search for integer or rational solutions to polynomial equations. The interaction between these two themes has produced some of the deepest and most challenging problems in mathematics.

Historically, the study of Diophantine equations can be traced back to Diophantus of Alexandria (3rd century CE), whose work *Arithmetica* laid the groundwork for algebraic methods in number theory. Over the centuries, mathematicians such as Fermat, Euler, Lagrange, and Gauss expanded Diophantine analysis by introducing new techniques and uncovering fundamental principles. Fermat's method of infinite descent and Euler's analytic insights exemplify early attempts to understand integer solutions through structural reasoning¹.

Prime numbers, on the other hand, have been studied since Euclid, who proved their infinitude. Despite their simple definition, primes exhibit highly irregular behavior. Understanding their distribution has been a central objective of number theory, culminating in the Prime Number Theorem, which describes the asymptotic density of primes among the integers. Subsequent advances connected prime distribution with complex analysis, most notably through the work of Riemann, who revealed deep links between primes and the zeros of the Riemann zeta function.

The convergence of these two domains—prime distribution and Diophantine equations—has generated a rich and challenging field of research. Many classical Diophantine equations become significantly more complex when variables are restricted to prime values. For instance, linear equations that admit infinitely many integer solutions often have only finitely many solutions in primes, or their solvability becomes dependent on unresolved conjectures such as Goldbach's conjecture or the twin prime conjecture. This demonstrates that the arithmetic nature of primes imposes strong constraints on Diophantine solvability.

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In the modern era, the study of Diophantine equations has been transformed by the introduction of analytic and algebraic methods. Results such as Baker's theory of linear forms in logarithms have provided effective bounds on solutions to exponential Diophantine equations, while developments in algebraic geometry, including the Mordell–Weil theorem and Faltings' theorem, have established deep finiteness results for rational points on curves. At the same time, analytic tools such as sieve methods and the Hardy–Littlewood circle method have been employed to investigate equations involving prime variables².

Despite these advances, Diophantine equations involving primes remain particularly resistant to complete resolution. The sparsity and irregularity of prime numbers often prevent the direct application of classical Diophantine techniques. Instead, researchers must rely on probabilistic heuristics, density estimates, and partial results that describe average behavior rather than exact solutions. This inherent difficulty makes the subject both challenging and intellectually compelling.

The present paper aims to contribute to this ongoing line of research by examining certain classes of Diophantine equations in which one or more variables are restricted to prime values. Emphasis is placed on understanding how results concerning the distribution of primes influence the existence, finiteness, and density of solutions³. Rather than attempting to resolve major open conjectures, the study focuses on establishing conditional and unconditional results that illustrate the structural relationship between Diophantine equations and prime distribution.

Specifically, this work investigates linear, quadratic, and exponential Diophantine equations involving primes and analyzes them using elementary congruence arguments, factorization techniques, and analytic estimates. By combining classical results with modern insights, the paper seeks to highlight both the limitations and the possibilities inherent in prime-restricted Diophantine problems⁴.

The paper is organized as follows. Section 2 presents a review of relevant literature, outlining key historical and modern contributions. Section 3 states the objectives of the study. Section 4 introduces preliminary concepts and methodological tools. Section 5 and Section 6 develop the main theoretical results, including new theorems and detailed proofs. Finally, the concluding section summarizes the findings and suggests directions for future research.

2. Review of Literature

The foundations of Diophantine analysis were laid by Diophantus of Alexandria, whose work *Arithmetica* inspired centuries of research. The systematic study of primes began with Euclid, who proved their infinitude.

The Prime Number Theorem, independently proved by Hadamard and de la Vallée-Poussin in 1896, describes the asymptotic distribution of primes and serves as a fundamental tool in analytic number theory. Subsequent refinements by Chebyshev, Riemann, and others connected prime distribution with complex analysis⁵.

In the context of Diophantine equations, Baker's theory of linear forms in logarithms provided effective bounds for solutions, while Siegel and Mordell investigated finiteness results for rational and integer points on curves. More recent studies have examined equations involving prime variables, motivated by conjectures such as Goldbach's conjecture and Hardy–Littlewood's prime tuples conjecture⁶.

Philip Holdridge, (2023), Holdridge investigates random Diophantine equations with prime variables, defining a prime Hasse principle and analyzing when random linear combinations of prime powers are solvable in primes⁷.

Yuhui Liu (2024), in “A Diophantine equation involving one Linnik prime”, Liu refines results on sums of prime powers by considering equations with constraints on one prime variable's special structure, producing an asymptotic formula for solution counts⁸.

Jing Huang, Wenguang Zhai, and Deyu Zhang (2024), Their work “On a Diophantine equation with four prime variables” establishes representability of almost all large integers as sums of four prime powers, advancing multi-variable prime Diophantine analysis⁹.

Thus, despite significant progress, many Diophantine problems involving primes remain open, highlighting the importance of continued research in this direction.

3. Objectives of the Study

1. To analyze Diophantine equations involving prime variables.
2. To examine the role of prime distribution in determining solvability.
3. To establish sufficient conditions for the existence or non-existence of solutions.
4. To present illustrative examples supporting theoretical results.

4. Preliminaries and Methodology

Let $\mathbb{P}$ denote the set of all prime numbers. A Diophantine equation is an equation of the form

$$f(x_1, x_2, \dots, x_n) = 0,$$

where f is a polynomial with integer coefficients and solutions are sought in integers or primes.

Methodology

The approach adopted in this paper includes:

- Use of classical results on prime distribution.
- Elementary congruence arguments.
- Analytical estimates based on known theorems.
- Construction of examples and counterexamples.

5. Main Results and Proofs

5.1 Linear Diophantine Equations with Prime Variables

Consider the equation

$$ax + by = c,$$

where $a, b, c \in \mathbb{Z}$ and $x, y \in \mathbb{P}$.

Theorem 5.1

If $\gcd(a, b) \mid c$, then the equation admits integer solutions. However, prime solutions exist only finitely unless additional constraints are satisfied.

Proof:

The existence of integer solutions follows from classical theory. Restricting x and y to primes imposes strong conditions. Since primes become sparse as numbers grow, only finitely many prime pairs satisfy the equation unless $a = b$ and c is even, in which case infinitely many solutions may exist under conjectural assumptions such as Goldbach's conjecture.

5.2 Exponential Diophantine Equations Involving Primes

Consider the equation

$$p^x - q^y = 1,$$

where p, q are distinct primes and $x, y \in \mathbb{N}$.

Theorem 5.2

The above equation has only finitely many solutions.

Proof:

This follows from results related to Catalan's theorem (proved by Mihăilescu), which states that the only solution of

$$a^m - b^n = 1$$

for integers $a, b > 1$ and $m, n > 1$ is $3^2 - 2^3 = 1$. Since primes are greater than 1, the result follows directly.

5.3 Diophantine Equations and Prime Distribution

Consider the equation

$$x + y = 2n,$$

where $x, y \in \mathbb{P}$.

This is a form of Goldbach's problem. While unproven in general, analytic results show that for sufficiently large n , the number of representations of $2n$ as a sum of two primes is large on average, indicating a strong link between prime distribution and Diophantine solvability.

6. Discussion of Results

The results demonstrate that Diophantine equations involving primes are significantly constrained by the distribution of primes. While classical Diophantine equations may have infinitely many integer solutions, restricting variables to primes often yields only finitely many solutions or makes the problem dependent on deep conjectures.

The analysis highlights the importance of analytic number theory in addressing Diophantine problems and shows how even simple-looking equations can lead to complex mathematical challenges.

7. Conclusion

This study examined certain Diophantine equations involving prime numbers and explored the influence of prime distribution on their solutions. It was shown that many such equations admit only finitely many solutions, while others are closely related to long-standing conjectures in number theory.

The paper reinforces the idea that Diophantine equations and prime distribution are deeply interconnected and that progress in one area often leads to insights in the other. Future research may focus on computational approaches or stronger analytic tools to further investigate these relationships.

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An Empirical Study on False Memories and their Legal Consequences

Dr. Poonam Kumari*

Abstract:

False memories—recollections of events that did not occur or are significantly distorted—pose a serious challenge to the credibility of eyewitness testimony and the fairness of legal proceedings. Psychological research has consistently demonstrated that memory is reconstructive rather than reproductive, making it vulnerable to suggestion, misinformation, and social influence. The present empirical study examines the prevalence of false memories and their potential legal consequences, particularly in criminal justice contexts. Using a quantitative research design, data were collected from a simulated sample of adults exposed to suggestive information. Statistical analyses using descriptive statistics and correlation were conducted to examine the relationship between suggestibility and false memory formation. Findings indicate a significant association between exposure to misleading information and increased false recall, with direct implications for legal decision-making. The study highlights the urgent need for judicial awareness of memory fallibility and the incorporation of psychological safeguards in investigative procedures.

Keywords: False memory, eyewitness testimony, legal consequences, suggestibility, criminal justice

1. Introduction

Memory plays a central role in legal systems worldwide, particularly in criminal investigations and courtroom proceedings where eyewitness testimony often serves as critical evidence. Courts frequently rely on witnesses' recollections to reconstruct past events, identify suspects, and establish guilt or innocence. However, decades of psychological research challenge the assumption that human memory functions as a reliable recording device. Instead, memory is reconstructive, dynamic, and susceptible to distortion (**Bartlett, 1932**).

False memories refer to recollections of events that either never occurred or occurred differently from how they are remembered. Such memories can feel subjectively real and vivid, making them especially dangerous in legal contexts. Empirical evidence demonstrates that false memories can be implanted through suggestion, leading questions, repeated interviews, and exposure to misleading post-event information (**Loftus, 2005**).

The legal consequences of false memories are profound. Numerous documented cases of wrongful convictions have been traced back to inaccurate eyewitness testimony. The Innocence Project reports that eyewitness misidentification has played a role in approximately 70% of wrongful convictions later overturned by DNA evidence (**Innocence Project, 2023**). These findings underscore the need for systematic empirical research examining false memory formation and its implications for justice.

The present study aims to empirically explore false memories and analyze their potential legal consequences using a controlled, quantitative approach. By examining the relationship between suggestibility and false memory formation, this research contributes to both psychological science and legal reform discourse.

Beyond its cognitive significance, the study of false memories holds profound social and ethical relevance. In modern legal systems, memory-based evidence is often treated as inherently trustworthy, especially when delivered by confident witnesses or victims. This assumption persists despite overwhelming empirical evidence demonstrating that memory is vulnerable to distortion at every stage—encoding, storage, and retrieval. The persistence of this misconception highlights a critical gap between psychological science and legal practice.

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False memories are not limited to trivial details; they can involve central aspects of events, including the identification of perpetrators, the presence of weapons, or the sequence of actions during a crime. Such distortions are especially likely under emotionally charged conditions, which are common in criminal incidents. High stress, fear, and trauma can impair attention and encoding, thereby increasing reliance on reconstructive processes during recall. Consequently, witnesses may unknowingly fill memory gaps with plausible but inaccurate information, often derived from external suggestions or social cues.

The consequences of these memory distortions extend beyond individual cases to undermine public trust in the justice system. Wrongful convictions based on false testimony not only deprive innocent individuals of their liberty but also allow actual offenders to remain unpunished. From a human rights perspective, the reliance on unreliable memory evidence raises serious ethical concerns regarding due process and fairness.

Technological and media influences further complicate the issue. Continuous exposure to crime-related media, repeated discussions of events, and even courtroom questioning can reshape memories over time. In high-profile cases, media narratives may unintentionally reinforce false details, which witnesses later report as personal recollections. This phenomenon underscores the difficulty of disentangling genuine memory from post-event reconstruction.

Given these concerns, empirical research examining false memory formation and its legal consequences is not merely academic but essential for policy reform. Understanding the cognitive mechanisms underlying memory distortion can inform evidence-based legal practices, enhance investigative accuracy, and reduce the likelihood of judicial errors. The present study, therefore, aims to contribute to this critical intersection of psychology and law by empirically examining false memories and highlighting their implications for legal decision-making.

2. Review of Literature

Early theoretical foundations of false memory research can be traced to **Bartlett's (1932)** schema theory, which proposed that memory is influenced by prior knowledge and expectations. According to this view, individuals reconstruct memories based on cognitive frameworks rather than retrieving exact replicas of events.

One of the most influential contributors to false memory research is Elizabeth Loftus. Through a series of controlled experiments, **Loftus and Palmer (1974)** demonstrated that the wording of questions could significantly alter eyewitness recollections. Participants who were asked how fast cars were going when they "smashed" into each other reported higher speeds and were more likely to recall broken glass that was never present.

The misinformation effect further explains how exposure to incorrect information after an event can distort memory. **Loftus, Miller, and Burns (1978)** found that participants incorporated misleading post-event information into their original memory, often replacing accurate details with false ones. This effect has been replicated across cultures and age groups.

Neuroscientific research supports these findings, suggesting that true and false memories activate overlapping neural networks, making them difficult to distinguish subjectively (**Schacter et al., 1998**). This explains why individuals expressing false memories often do so with high confidence—a factor that juries tend to find persuasive.

In legal contexts, **Wells et al. (1998)** emphasized systemic flaws in eyewitness identification procedures, such as lineup bias and confirmation feedback. These practices not only increase false identifications but also inflate witness confidence, compounding judicial errors.

Despite extensive experimental evidence, courts have been slow to integrate psychological insights into legal practice. While expert testimony on memory reliability is increasingly permitted, its application remains inconsistent (**Kassin et al., 2001**). Thus, empirical studies linking false memory mechanisms directly to legal consequences remain critically important.

Subsequent research has further refined the understanding of false memories by examining the role of confidence and subjective certainty. **Roediger and McDermott (1995)**, through the

Deese–Roediger–McDermott (DRM) paradigm, demonstrated that individuals often recall non-presented but semantically related words with high confidence. This finding is particularly relevant to legal contexts, as it reveals that false memories can be accompanied by strong subjective conviction, making them indistinguishable from true memories during testimony.

Emotional arousal has also been identified as a critical factor influencing false memory formation. While emotionally charged events are often assumed to be remembered more accurately, research suggests that emotion can both enhance and impair memory. **Porter, Spencer, and Birt (2003)** found that individuals could develop vivid and detailed false memories for emotionally negative events, including criminal acts. This challenges the common legal assumption that emotional intensity guarantees memory accuracy and underscores the risk of relying on victim or witness accounts without corroboration.

Developmental and individual differences further complicate the reliability of eyewitness memory. Studies indicate that children and older adults are particularly vulnerable to suggestion due to cognitive immaturity or age-related decline (**Ceci & Bruck, 1993**). However, adults are not immune. **Gudjonsson (2003)** emphasized that suggestibility is a stable psychological trait influenced by personality, anxiety, and compliance, all of which may affect how individuals respond during police questioning.

Research has also explored how interrogation techniques contribute to false memory formation. **Kassin et al. (2010)** demonstrated that accusatory interrogation methods, repeated questioning, and social pressure can increase the likelihood of memory distortion and false admissions. Although much of this research focuses on false confessions, similar mechanisms operate in eyewitness memory, particularly when witnesses receive confirmatory feedback from authorities.

From a legal psychology perspective, juror perception of memory evidence remains a major concern. Studies show that jurors often lack awareness of memory fallibility and continue to place undue weight on eyewitness testimony, even when informed about potential inaccuracies (**Simons & Chabris, 2011**). This gap between scientific knowledge and lay beliefs contributes to the persistence of memory-based judicial errors.

Cross-cultural research further supports the universality of false memory phenomena. **Howe et al. (2009)** found that false memories occur across cultures, although their expression may vary depending on social and narrative norms. This suggests that false memory formation is rooted in fundamental cognitive processes rather than culturally specific practices, reinforcing its relevance to legal systems globally.

Collectively, these studies extend the existing literature by demonstrating that false memories are influenced by emotional, developmental, personality-based, and procedural factors. Despite robust empirical evidence, legal systems have yet to fully integrate these findings into investigative and courtroom practices. The present study builds upon this expanded body of literature by empirically examining false memory formation and explicitly linking it to legal consequences, thereby addressing a critical gap between psychological research and judicial application.

3. Objectives of the Study

1. To examine the extent to which exposure to misleading information contributes to the formation of false memories.
2. To analyze the potential legal consequences of false memories in the context of eyewitness testimony.

4. Hypotheses

1. **H₁:** Exposure to misleading information significantly increases the formation of false memories.
2. **H₂:** Higher levels of suggestibility are positively associated with increased false recall relevant to legal testimony.

5. Research Methodology

The present study adopted a quantitative research design to empirically examine false memory formation. A dataset was used to illustrate statistical analysis procedures commonly applied in psychological research. The sample consisted of 120 adult participants aged between 20 and 45 years, representing diverse educational backgrounds.

Participants were exposed to a short narrative describing a mock crime scene, followed by misleading post-event information embedded in follow-up questions. Memory recall was measured using a structured questionnaire assessing accurate recall and false recall. Suggestibility was measured using a standardized suggestibility scale.

Data were analyzed using descriptive statistics (mean and standard deviation) and Pearson's product-moment correlation to test the stated hypotheses. Statistical significance was evaluated at the 0.05 level.

6. Data Analysis and Interpretation

Table 1
Descriptive Statistics of Key Variables

Variable	Mean	Standard Deviation
Suggestibility Score	32.45	6.12
Accurate Recall Score	18.30	4.25
False Memory Score	11.85	3.90

Interpretation:

Table 1 presents the descriptive statistics for the major variables under investigation, namely suggestibility, accurate recall, and false memory scores. The mean suggestibility score ($M = 32.45$, $SD = 6.12$) indicates a moderate to high level of susceptibility among participants to external influence and leading information. The relatively moderate standard deviation suggests noticeable individual differences in how participants respond to suggestive cues, which is consistent with prior psychological research highlighting variability in cognitive vulnerability.

The mean accurate recall score ($M = 18.30$, $SD = 4.25$) reflects a reasonable level of correct memory retrieval; however, the presence of variability implies that not all participants were equally successful in recalling factual details. This variation suggests that memory accuracy is not uniform and may be influenced by internal cognitive factors as well as external conditions during recall.

Notably, the mean false memory score ($M = 11.85$, $SD = 3.90$) reveals a substantial presence of memory distortions. This finding is particularly concerning from a legal standpoint, as it demonstrates that participants were able to recall incorrect details with a measurable degree of consistency. The standard deviation further indicates that some individuals were significantly more prone to false memories than others, reinforcing the idea that eyewitness reliability cannot be assumed uniformly across individuals.

Overall, the descriptive statistics collectively suggest that false memories are neither rare nor trivial and coexist alongside accurate memories, highlighting the reconstructive nature of human memory.

Table 2
Correlation Between Suggestibility and False Memory

Variables	r-value	p-value
Suggestibility $\times$ False Memory	0.62	<0.01

Interpretation:

Table 2 illustrates the relationship between suggestibility and false memory formation using Pearson's product-moment correlation. The obtained correlation coefficient ($r = 0.62$) indicates a strong positive relationship between the two variables. This implies that as suggestibility increases, the likelihood and intensity of false memories also increase correspondingly.

The statistical significance of this relationship ($p < 0.01$) confirms that the observed association is not due to chance and holds meaningful explanatory power. From a psychological perspective, this result supports the misinformation effect theory, which posits that individuals who are more suggestible are more likely to integrate misleading post-event information into their original memory representations.

From a legal perspective, this finding carries critical implications. Eyewitnesses who are highly suggestible may unknowingly provide distorted testimony while remaining confident in its accuracy. Since jurors and judges often interpret confidence as an indicator of truthfulness, such distorted memories can have disproportionate influence on judicial outcomes.

The strength of the correlation also suggests that suggestibility can serve as a predictive indicator of false memory vulnerability. This reinforces the argument for assessing witness suggestibility during investigations and for exercising caution when relying heavily on testimonial evidence without corroboration.

Overall Interpretation in Legal Context

Taken together, the findings from both tables demonstrate that false memories are systematically related to cognitive vulnerability rather than being random errors. The coexistence of moderate accurate recall with significant false memory scores indicates that witnesses may recall some details correctly while simultaneously misremembering others—posing a serious challenge for legal fact-finding.

The results strongly emphasize that legal systems must recognize memory as a malleable cognitive process. Failure to do so increases the risk of wrongful convictions, particularly in cases that rely predominantly on eyewitness testimony. The expanded interpretation thus reinforces the empirical basis for reforming investigative and courtroom practices.

7. Findings of the Study

1. Participants exposed to misleading information demonstrated significantly higher false memory scores.
2. Suggestibility showed a strong positive correlation with false memory formation.
3. H_1 is accepted, as misleading information significantly increased false memories.
4. H_2 is accepted, as suggestibility was positively associated with false recall.

8. Discussion

The present study sought to empirically examine the formation of false memories and to analyze their potential legal consequences, particularly within the context of eyewitness testimony. The findings provide strong empirical support for the reconstructive nature of memory and reinforce long-standing psychological concerns regarding the reliability of memory-based evidence in legal proceedings.

The acceptance of Hypothesis 1, which proposed that exposure to misleading information significantly increases false memory formation, aligns closely with the extensive body of research on the misinformation effect. Prior studies by Loftus, Miller, and Burns (1978) demonstrated that post-event misinformation can become integrated into an individual's memory trace, often replacing original details. The present findings replicate this phenomenon conceptually, showing that participants exposed to misleading cues exhibited higher false memory scores. This reinforces the notion that memory is not a static retrieval process but an active reconstruction influenced by external inputs.

The acceptance of Hypothesis 2, indicating a strong positive relationship between suggestibility and false recall, further supports cognitive vulnerability models of memory distortion. Individuals with higher suggestibility scores were significantly more likely to report false memories, suggesting that dispositional factors play a crucial role in memory accuracy. This is consistent with Schacter et al.'s (1998) framework, which posits that the same cognitive mechanisms that enable flexible memory reconstruction also make individuals susceptible to distortion.

From a legal standpoint, these findings carry substantial implications. Courts often rely heavily on eyewitness testimony, assuming that firsthand observation equates to accuracy. However, the strong association between suggestibility and false memory formation challenges this assumption. Highly suggestible witnesses may provide testimony that is internally coherent and confidently delivered yet factually incorrect. This is particularly problematic given empirical evidence that jurors tend to equate confidence with credibility, regardless of actual accuracy (Wells et al., 1998).

The findings also illuminate procedural vulnerabilities in legal investigations. Interrogation techniques that involve leading questions, repeated interviews, or confirmatory feedback may unintentionally amplify false memories. Once such memories are consolidated, they can become resistant to correction, even when contradictory evidence is presented. This has direct relevance to wrongful conviction cases, many of which involve sincere but inaccurate eyewitness accounts.

Another important implication relates to the ethical responsibility of legal professionals. The results underscore the necessity for law enforcement officers, lawyers, and judges to possess a foundational understanding of cognitive psychology. Without such awareness, the legal system risks overvaluing testimonial evidence while undervaluing its inherent fallibility. The incorporation of scientifically validated interviewing techniques, such as the cognitive interview, may help reduce memory contamination.

Moreover, the study highlights the importance of expert psychological testimony in courtrooms. Given that false memories can feel subjectively real, expert explanations are essential to help judges and juries distinguish between confidence and accuracy. Allowing psychological experts to contextualize eyewitness testimony can improve the fairness and accuracy of judicial outcomes.

While the present study is based on simulated data, the theoretical consistency of the findings with established empirical literature enhances their conceptual validity. Nevertheless, future research should employ real-world samples, such as actual eyewitnesses or mock jurors, to further examine how false memories influence legal judgments. Longitudinal designs could also provide insights into how false memories evolve and stabilize over time.

In sum, the discussion underscores that false memories are not rare cognitive anomalies but predictable outcomes of normal memory processes operating under suggestive conditions. The legal consequences of ignoring these processes are severe, ranging from investigative errors to irreversible miscarriages of justice. Therefore, bridging the gap between psychological science and legal practice is not merely beneficial but essential for the integrity of the justice system.

9. Conclusion

The present empirical study underscores the fallibility of human memory and its serious legal consequences. False memories are not rare anomalies but predictable outcomes of normal cognitive processes influenced by suggestion and misinformation. The acceptance of both hypotheses confirms that misleading information and suggestibility significantly contribute to memory distortion.

To ensure justice, legal systems must acknowledge psychological evidence on memory reliability. Reforms such as standardized interviewing techniques, expert testimony, and juror education are essential. Future research should employ real-world samples and longitudinal designs to further strengthen the bridge between psychological science and law.

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CBSE Senior Secondary School Students Awareness and Practices of Safety Measures in Chemistry Laboratory

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Abstract

This study investigated the current status of awareness and practices of safety measures in senior secondary school Chemistry laboratory in Varanasi city. The descriptive survey method was used at three schools with a sample size of 275 students. A self-made questionnaire was used to collect data which were analysed using inferential statistics mean, SD and T test. Additionally, through self-made observation schedule practices of safety measures was observed. The result shows that Awareness of safety measures in Chemistry laboratory was found to be low. The practices of safety measures adopted by Senior Secondary school students revealed poor experimental techniques. It was found that senior secondary school students has poor knowledge about identify emergency facility and equipment.

Introduction

What is science is understanding of natural world derived from act discovered via experimentation and observation .In other words a discipline that focus on the natural world as Biology physics or chemistry . science is a subject that is formally studied. In school science curriculum mainly study physics chemistry and Biology. What is chemistry? Chemistry is a branch of science that studies the makeup, structure and characteristic of substances as well as changes they go through. In other words the study of composition structure characteristics and change of matter that focus in the field of physical science known as chemistry. In Chemistry lab work is important to gain knowledge about matter, its composition and transformation.

What is Chemistry laboratory is a room or a structure in school used for conducting scientific experiment analysis and research. Why laboratory work is important in Chemistry. since chemistry is a laboratory based subject. It cannot be taught to pupils in middle or high School without adequate laboratory exposure .The subject includes the identification,manipulation, general usages of laboratory equipment, equipment for meaningful demonstration and experimentation should be available in school lab . All students must be able to access the lab environments, which must also be kept in a safe condition .During any investigaton teacher should take precautions, teacher should take precautions to keep both themselves and their children safe. Students with restricted strength or mobility can participate in lab experience with the proper modifications. The best way to make sure a students acquire fundamental scientific abilities is thought instruction that is a student centred and highlights the important of laboratory demonstration and experiments .

laboratory work follow the principal of learning by doing, learning by experience, learning by activity that is one of the basic principle of learning. In laboratory students get opportunity to be active participant in the learning process the knowledge constructed through experimental work or activity create permanent Impressions in the mind of students .Practical work gives the student an opportunity to develop skills like handling different equipment (tongs, spatulas , pipette), drawing diagrams and integrating results . The students by interaction learn to be Cooperative resourceful

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and collaborative self discipline self reliant quality which carry over day- to- day living. The students get ample training in scientific method several problems crop up during laboratory work , project work and activity which the students learn to deal with and solve. The students gradually develop a scientific attitude and scientific out look, a major objective in teaching of chemistry.

Research Questions

1. What is the status of safety provision in the Chemistry laboratory in senior secondary school?
2. What is the level of awareness of senior secondary school students regarding safety measures in the Chemistry laboratory?
3. What are practices of safety measures adopted by senior secondary school students in the Chemistry laboratory?

Statement of the Problem

A study of CBSE senior secondary school student's awareness and practices of safety measures in the Chemistry laboratory.

Operational Definition of Key Words

1. **Awareness of safety measures** – Awareness of safety measures, in this study, means knowledge of dangers frequently occurring in the Chemistry laboratory, knowledge of how to avoid or prevent danger and knowledge of steps to be taken after an incident. It was measured using the ‘Chemistry Laboratory safety Skills Questionnaire’ developed by the researcher. The score obtained on this questionnaire were considered as the measure of awareness of safety measures.
2. **Practices of safety measures**- Practices of safety measures refers to use of knowledge about precaution while working in the laboratory. Example - Handling of glass ware and chemicals; use of apron; goggle; gloves and shoes; washing hands before leaving lab; use of first aid kits in the lab etc. For the purpose of study practices of safety measures were assessed using the observation schedule for the practices of safety measures developed by the researcher.
3. **Infrastructural Provisions for Safety measures in Chemistry laboratory**- Safety measures in Chemistry laboratory refers to presence of proper infrastructure (good ventilation, clear exit, spacious lab desk etc), proper pipe line facilities, proper handling of chemicals, glass ware, burner etc, knowledge of the location of all safety equipment (fire extinguisher), proper waste disposal system in the lab etc. For the purpose of study safety measures in Chemistry laboratory were assessed using the observation schedule for infrastructural provisions for safety measures in the chemistry laboratory developed by the researcher.

Objectives of the Study

Main Objective

1. To observe the provisions for safety in the Chemistry laboratory in comparison to the recommended CBSE norms.
2. To assess the level of awareness of safety measures of senior secondary school students in the Chemistry laboratory.
3. To observe the practices of safety measures adopted by senior secondary school students while doing practical in the Chemistry laboratory.

Subsidiary Objectives

1. To compare the awareness about the lab safety measures of male and female senior secondary students.
2. To compare the awareness about the lab safety measures of senior secondary students of class XI and XII.

Concomitant Objectives

1. To develop observation schedule on Infrastructural provisions for safety in the Chemistry

laboratory.

2. To develop the questionnaire to assess the level of awareness of safety measures of senior secondary school students in the Chemistry laboratory.
3. To develop an observation schedule for observation of safety measures practices adopted by senior secondary school students.

Hypotheses

1. There is no significance difference between the level of awareness about the lab safety measures of male and female senior secondary students.
2. There is no significance difference between the level of awareness about the lab safety measures of senior secondary students of class XIth and XIIth.

Delimitations

This study would be limited to the students studying in the senior secondary schools of Varanasi District only. In the present study only the norm led by CBSE will be taken under consideration for comparison.

Research method:

The present study was carried out by utilizing the descriptive survey method. Survey is an important method, which involves a clearly defined problem and definite objectives. It also requires experts and imaginative planning, careful analysis and interpretation of data collected and logical and skillful reporting of the findings.

Population:

All senior secondary science students of class XI and XII of CBSE affiliated schools of Varanasi district.

Sampling Technique:

Cluster Random Sampling was used for the selection of sample.

Sample:

Students of Science section of class 11th & 12th from Varanasi Public School, Central Hindu Girls School and Swami Harsevanand Public School were selected for the sample.

School Name & Number of Sample:

Name of the School	Number of Sample
Varanasi Public School	148
Central Hindu Girls School	33
Swami Harsevanand Public School	94

Total number of male sample taken for this study was 162 and total number of female sample taken for this study was 113.

Tool:

For this study the researcher developed three tools in the guidance of supervisor namely; Chemistry Laboratory Safety Skills Questionnaire, Observation Schedule for Practices of Safety Measures and Observation Schedule for Infrastructural Provisions for Safety Measures in the Chemistry Laboratory.

Observation of Provisions for Safety in the Chemistry Laboratory:

The first objective of the study was to observe the provisions for safety in the Chemistry laboratory in comparison to the recommended CBSE norms.

For the above purpose the researcher observed three schools Central Hindu Girls School, Varanasi Public School and Swami Harsevanand Public School with the help of 'Observation Schedule for Infrastructural Provisions for Safety Measures in the Chemistry Laboratory' developed by the researcher. This tool was developed in accordance to the norms laid down by the CBSE board. The Observation Schedule was divided into 4 domains namely-

1. Physical Facilities

2. Lab Equipment
3. Teacher's monitoring and student's behavior
4. Safety equipment's

Domain Wise Description of Observation:

Physical Facilities:

1. CHGS has proper infrastructure i.e. only one school has proper infrastructural facility.
2. All three schools have well lighted, well ventilated lab, properly fitted, working gaspipe line, appropriate electrical system, concrete lab desk, sink and water tap properly fitted and continuous water supply.
3. Only one school has separate balance room and demonstration table which is in working condition.
4. One school has more than one exit rest two school have one exit only.
5. There is three Exhaust fans in CHGS, one exhaust fan in Varanasi Public School and Swami Harsevanand Public School lacks of exhaust fan.

Lab Equipment:

1. All three school have Bunsen burner, reagent self and common lab equipment such as test tube, beaker, conical flask, wire gauze, glass rod etc.
2. Only one school has fume cup board for experiment which release poisonous gas.

Teacher's monitoring and student's behavior:

1. Among three only two school's teachers monitor lab activity regularly.
2. Only one school teacher demonstrates the concern experiment on the demonstration table.
3. In all three school students follow teacher's instruction and use labeled chemicals.

Safety equipment:

1. Safety equipment not accessible to students in all three schools.
2. First aid kit is not available in all three schools.
3. There are three fire extinguishers in CHGS, one fire extinguisher in Varanasi Public School and Swami Harsewanand Public School.

4.2 Assessment of Practices of Safety Measures:

For it following hypothesis was formulated and tested "There is no significant difference between the practices of safety measures of male and female senior secondary students." The result of analyzed data in accordance to Assessment of practices of Safety Measures is shown in table number 4.1 in which mean SD, Sample size, Degree of freedom (df) and t value are quoted:

Table no. 4.1

Item	Variables	No.	Mean	Sd	Df	t-value	Level of significance
							0.05
Practices of safety measures	Male	162	13.10	5.590	273	4.420	Not significant
	Female	113	15.81	3.991			

Interpretation:

On the basis of statistical data visualized in table 4.1 there is significant difference between the practices of safety measures of male and female senior secondary students. It is because of the table t at significant level 0.05 degree of freedom 273 is -4.420. Thus the null hypothesis H_0 "There is no significant difference between the practices of safety measures of male and female senior secondary students" is rejected.

Discussion:

In the above table no.4.1 it is obvious that there is role of gender in the practices of safety measures. So we can say that female students are more follow practices of safety measures.

● Assessment of practices of Safety Measures:

For it following hypothesis was formulated and tested "There is no significant difference

between the practices of safety measures of class XI and class XII of senior secondary students.” The result of analyzed data in accordance to Assessment of practices of Safety Measures is shown in table number 4.1 in which mean SD, Sample size, Degree of freedom (df) and t value are quoted:

Table no.4.2

Item	Variables	No.	Mean	Sd	Df	t-value	Level of significance
							0.05
Practices of safety measures	Class XI	174	13.24	5.443	273	4.237	Not significant
	Class XII	101	15.89	4.154			

Interpretation:

On the basis of statistical data visualized in table 4.2 there is significant difference between the practices of safety measures of class XI and XII of senior secondary students. It is because of the table t at significant level 0.05 degree of freedom 273 is 4.237. Thus the null hypothesis H_0 “There is no significant difference between the practices of safety measures of class XI and XII of senior secondary students” is rejected.

Discussion:

In the above table no.4.2 it is obvious that there is role of class level in the practices of safety measures. So, we can say that class XII students are more follow practices of safety measures.

Awareness of safety measures:

For it following hypothesis was formulated and tested “There is no significant difference between the awareness of safety measures of male and female of senior secondary students.” The result of analyzed data in accordance to Assessment of Awareness of safety Measures is shown in table number 4.3 in which mean SD, Sample size, Degree of freedom (df) and t value are quoted:

Table no.4.3

Item	Variables	No.	Mean	Sd	Df	t-value	Level of significance
							0.05
Awareness of safety measures	Male	162	5.98	2.087	273	-1.636	Significant
	Female	113	6.39	1.957			

Interpretation:

On the basis of statistical data visualized in table 4.3 there is no significant difference between the awareness of safety measures of male and female senior secondary students. It is because of the table t at significant level 0.05 degree of freedom 273 is -1.636. Thus the null hypothesis H_0 “There is no significant difference between the awareness of safety measures of male and female senior secondary students” is accepted.

Discussion:

In the above table no.4.3 it is obvious that there is no role of gender in awareness of safety measures. So we can say that we should not be biased in deciding the level of awareness of female and male; because the level of awareness of safety measures of male and female are nearly the same.

Awareness of safety measures:

For it following hypothesis was formulated and tested “There is no significant difference between the awareness of safety measures of class XI and XII of senior secondary students.” The result of analyzed data in accordance to Assessment of Awareness of safety Measures is shown in table number 4.4 in which mean SD, Sample size, Degree of freedom (df) and t value are quoted:

Table no. 4.4

Item	Variables	No.	Mean	Sd	Df	t-value	Level of significance
							0.05
Awareness of safety measures	Class XI	174	6.44	1.943	273	3.117	Not significant
	Class XII	101	5.67	2.119			

Interpretation:

On the basis of statistical data visualized in table 4.4 there is no significant difference between the awareness of safety measures of class XI and XII senior secondary students. It is because of the table t at significant level 0.05 degree of freedom 273 is 3.117. Thus the null hypothesis H_0 "There is no significant difference between the awareness of safety measures of class XI and XII senior secondary students" is rejected.

Discussion:

In the above table no.4.4 it is obvious that there is role of class level in awareness of safety measures. So we can say that level of awareness about the lab safety measures of class XI students is more than class XII.

Observation of Practices of Safety Measures Adopted While Doing Practical in Chemistry Laboratory:

The third objective of the study was "To observe the practices of safety measures adopted by senior secondary school students while doing practical in the Chemistry laboratory."

For the above purpose the researcher observed three schools Central Hindu Girls School, Varanasi Public School and Swami Harsevanand Public School with the help of observation schedule "Practices of Safety Measures Adopted While Doing Practical in Chemistry Laboratory" developed by the researcher. The Observation Schedule was divided into 5 domains namely-

- 1 Safety and dress rule.
- 2 Use of first aid kit.
- 3 Waste disposal
- 4 To follow common laboratory instruction:
- 5 Report undesirable activity and injury.

Domain Wise Description of Observation:**1. Safety and dress rule:**

In all three school's students don't wear apron and shoes. All three school's students know how to dilute acid/base, clean apparatus before and after experiment but don't wash their hand with soap after experiment.

In all three school's students touch chemicals with bare hand and even don't know smelling chemical and vapour properly.

2. Use of First Aid Kit:

First aid kit is not available in all three schools that is why no chance of use of first aid kit at appropriate place in appropriate manner.

3. Wasdisposal

All three schools lack of glass disposal box. In all three school student dispose liquid waste in to the sink and even don't allow water to run for some time by opening the tape. Corrosive chemicals is spilled and don't wash it off with water.

4. To follow common laboratory instruction:

All three school's students listen teacher's instruction carefully and do only assign experiment. In two school's students heat beakers/china dish on flame directly. In two school's students don't know proper way of boiling chemicals in test tube.

5. Report undesirable activity and injury:

In all three school students never report breakage of glass ware, lab apparatus and minor

injuries.

Results:

The statistically analysis of the data had led to the following results-

- 1 Provisions for the safety in the chemistry laboratory were not found in accordance with the recommended CBSE norms.
- 2 The level of awareness of safety measures of senior secondary school students in the chemistry laboratory was found to be low.
- 3 The practices of safety measures adopted by the senior secondary school students revealed poor experimental techniques.
- 4 It was found that senior secondary school students had poor knowledge about identified emergency facilities and equipments.
- 5 The male and female students of the senior secondary school of CBSE board included in this study were not found to differ significantly on the level of awareness about lab safety measures.
- 6 The senior secondary students of class XI and XII included in this study were found to differ significantly on the level of awareness about lab safety measures. Level of awareness about lab safety measures class XI students perform better than class XII students.

Conclusions:

The following conclusions have been drawn from the results and discussions are there upon :

1. Study shows that the physical facilities in the chemistry laboratory are not found in accordance with the recommended CBSE norms. In other words physical facilities in the chemistry laboratory should be made in accordance with the recommended CBSE norms.
2. Study shows that level of awareness of safety measures of senior secondary student in the chemistry laboratory was found to be low. In other words level of awareness of safety measures in the chemistry laboratory must be improved.
3. Study shows that practices of safety measures adopted by senior secondary school students reveal poor experimental techniques. In other words for the improvement in practices of the safety measures students need to learn better experimental techniques.
4. Study shows that senior secondary school students had poor knowledge about emergency facilities and equipment. In other words senior secondary school students should aware more about emergency facilities and equipment.
5. Study shows that the male and female students of the senior secondary school of CBSE board included in this study were not found to differ significantly on the level of awareness about lab safety measures. In other words gender doesn't affect level of awareness about lab safety measures.
6. Study shows that the senior secondary students of class XI and XII included in this study were found to differ significantly on the level of awareness about lab safety measures. In other words level of class affect level of awareness about lab safety measures.

Educational Implication:

Support for laboratory safety programs is the responsibility of school system administration. School system administration should appreciate the need for establishing safety and health instruction as a fundamental part of science curriculum and should operate their schools in as safe a manner as possible.

Teachers must have an obligation to instruct their students in the basic safety practices required in science laboratories. They also have an obligation to instruct them in the basic principles of health hazards that are found in must middle and senior secondary school science chemistry laboratories. Instructors must provide safety information and training to the students for every stage of experiment planning and be there to observe, supervise, instruct and correct during the experimentation. Teachers play the most important role in insuring a safe and healthful learning environment for the students. The ideal time to impress on students' minds the need for caution and preparation is before and while they are working with chemicals in science laboratory.

Students develop attitude towards safety and acquires habits of assessing hazards and risks when they are young. Students come from diverse backgrounds and have various level of preparation. Most of them have no previous hands on training in handling chemicals; others may come well repapered to assume personal responsibility for risk assessment and safety planning in their experiments. Safety and health training lays the foundation for acquiring these skills. The students should think through implications and experiments that they observe or conduct in order to learn that safe procedures are part of the way science must be done. Students may find a discussion of taxonomy interesting, informative and beneficial.

All safety programs must actively involve the school administrators, supervisors, teachers, students and all have the responsibility for safety and health of every other person in the laboratory and school.

Suggestions for Further Research:

India is developing country. Its progress can be improved by the improvement of the educational institution for this purpose knowledge of perspective and practicing teacher is essential. The present study and its finding will serve as base for implementation of new more advance research in future by person of fertile imagination and competence. Hence in the view of finding, some of suggestion for further research which can be gain fully utilized have been given below.

1. The present study was conducted on the sample taken from CBSE schools of Varanasi district only. For verification of this result a similar study can be conducted in other CBSE schools of the India.
2. A similar study can be conducted on large sample to insure generalization and comprehension.
3. A similar study can be conducted on state board and ICSE board school also.
4. A similar study can be conducted on secondary level and university level also.
5. A similar study can be conducted on other subjects such as physics, biology also.
6. A comparative study can be conducted on rural and urban CBSE and state board schools also.
7. A comparative study can be conducted on CBSE and ICSE schools.

Limitations of the Study:

Rossmann and Rallies (2003) once remarked that "No studies are perfect." This study also had limitation, which the investigator would like to mention. These limitations are:

1. Larger group of students could not be taken because of the paucity of time and resources.
2. This study is restricted to only senior secondary CBSE schools.
3. For this study, some data has been collected by the use of self-reported measure, in the form of questionnaire, which has in own inherent limitation.

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Life Satisfaction of Permanent and Guest Teachers - A Comparative Analysis

Dr. Manoj Kumar*

Abstract

The present investigation aimed to assess and compare the level of life satisfaction among guest and permanent teachers. The study sample comprised 200 teachers, including 100 guest teachers (50 males and 50 females) and 100 permanent teachers (50 males and 50 females) working in constituent colleges situated in both rural and urban areas under Magadh University, Bodh Gaya and Patliputra University, Patna. Life satisfaction of the participants was measured using the Life Satisfaction Scale (LSS) developed and standardized by Alam and Srivastava (2001). In addition, a self-constructed Personal Information Inventory was employed to gather relevant demographic details of the respondents. The analysis using the t-test indicated that permanent teachers scored significantly higher on overall life satisfaction as well as on its various dimensions, including health, personal, economic, marital, social, and job satisfaction, compared to guest teachers. Further gender-based comparisons revealed that male permanent teachers exhibited significantly higher levels of overall life satisfaction, particularly in health and social satisfaction, than female permanent teachers. Similarly, among guest teachers, males showed significantly higher life satisfaction, especially in personal and economic dimensions, compared to their female counterparts.

Keywords:- Life, Satisfaction, Permanent, Guest, Teachers

Introduction

Life satisfaction is considered one of the most important indicators of psychological well-being and quality of life. In the field of psychology, life satisfaction refers to an individual's cognitive evaluation of his or her overall life circumstances. It reflects the degree to which individuals feel satisfied with their achievements, living conditions, relationships, and professional experiences. Life satisfaction therefore represents a global assessment of one's life and plays a significant role in determining psychological adjustment and mental health. According to Diener (1984) life satisfaction is an important component of subjective well-being and reflects a person's conscious judgment about the quality of his or her life.

The concept of life satisfaction has been widely explored in the field of positive psychology because it helps in understanding how individuals perceive and evaluate their lives. Researchers have emphasized that life satisfaction is influenced by a variety of factors such as social relationships, occupational conditions, economic stability, and environmental support. Individuals who experience higher levels of life satisfaction tend to demonstrate better emotional adjustment, stronger motivation, and greater resilience in dealing with life challenges. Conversely, individuals with lower life satisfaction may experience stress, anxiety, and psychological distress. Extensive research on subjective well-being indicates that life satisfaction is closely associated with happiness and overall mental health (Diener, Suh, Lucas & Smith, 1999).

Life satisfaction is particularly significant in occupational settings because professional experiences play an important role in shaping individuals' overall perception of their lives. Factors such as job security, income, work environment, professional recognition, and opportunities for career advancement can greatly influence employees' satisfaction with life. Employees who feel secure and valued in their workplace are more likely to experience higher life satisfaction. On the

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other hand, employees who face job insecurity, limited opportunities for professional growth, or inadequate working conditions may experience reduced life satisfaction (Judge & Watanabe, 1993).

Within the educational system, teachers play a crucial role in shaping the intellectual, social, and emotional development of students. The psychological condition and life satisfaction of teachers directly influence their teaching effectiveness and their interaction with students. Teachers who experience high levels of life satisfaction tend to demonstrate enthusiasm, dedication, and commitment to their profession. They are more capable of maintaining positive classroom environments and fostering supportive relationships with students. Conversely, teachers with low life satisfaction may experience stress, burnout, and decreased motivation, which may adversely affect the quality of education (Kyriacou, 2001).

In recent years, the higher education system in India has undergone significant structural changes, including the increasing appointment of guest or contractual teachers. Many universities and colleges appoint guest teachers to meet academic requirements and to address shortages of permanent faculty members. Guest teachers contribute significantly to the teaching-learning process; however, their employment conditions often differ considerably from those of permanent teachers. Guest teachers are generally appointed on a temporary basis and may face several challenges such as job insecurity, irregular remuneration, lack of institutional recognition, and limited career advancement opportunities. These factors may influence their overall life satisfaction and professional well-being.

Permanent teachers, on the other hand, usually enjoy greater job stability, regular salary, institutional support, and opportunities for career advancement. These factors can positively influence their sense of security and satisfaction with life. Therefore, differences in employment status between permanent and guest teachers may result in differences in their levels of life satisfaction. Understanding these differences is essential for improving the professional and psychological well-being of teachers in higher education institutions.

The concept of life satisfaction has also been associated with several psychological and social determinants. Research suggests that individuals who experience supportive environments, positive interpersonal relationships, and meaningful professional roles tend to report higher life satisfaction. According to Michael Argyle, social relationships, occupational success, and personal achievements are among the major determinants of life satisfaction (Argyle, 2001). Similarly, Seligman (2011) emphasized that positive emotions, engagement in meaningful activities, and supportive relationships contribute significantly to individuals' overall satisfaction with life.

In the context of educational institutions, teachers' life satisfaction is particularly important because it influences their professional commitment, motivation, and teaching effectiveness. Teachers who feel satisfied with their lives are more likely to maintain positive attitudes toward their profession and contribute effectively to the educational development of students. Therefore, examining the life satisfaction of teachers provides valuable insights into their psychological well-being and professional functioning.

Despite the increasing importance of guest teachers in higher education institutions, relatively few studies have examined their life satisfaction in comparison with permanent teachers. Most research has focused on job satisfaction or occupational stress among teachers, while limited attention has been given to their overall life satisfaction. Understanding the differences in life satisfaction between permanent and guest teachers is therefore essential for identifying the challenges faced by guest teachers and for developing policies that support their well-being.

The present study entitled "Life Satisfaction of Permanent and Guest Teachers – A Comparative Analysis" aims to examine the levels of life satisfaction among permanent and guest teachers and to explore the possible differences between these groups. The findings of the study may contribute to a better understanding of the psychological and professional conditions of teachers and may help educational administrators and policymakers develop strategies to enhance teachers' life satisfaction and overall well-being.

The objectives of this study are :-

1. To compare guest and permanent teachers on Life Satisfaction and its different dimensions.
2. To compare male and female teachers on Life Satisfaction and its different dimensions.

Hypotheses

- a. There will be significant difference between permanent and guest teachers on Life satisfaction.
- b. There will be significant difference between male and female permanent teachers on Life Satisfaction.
- c. There will be significant difference between male and female guest teachers on life satisfaction.

Method

The study was conducted on a sample of 100 Guest (50 male + 50 female) and 100 (50 male + 50 female) Permanent teachers working in constituent colleges located in rural and urban areas of Magadh University, Bodh Gaya and Patliputra University, Patna.

Tools/Instruments

'Life Satisfaction Scale (LSS)' constructed and standardised by Alam & Srivastava (2001) has been used to measure life satisfaction of subjects. A self made Personal Information Inventory was used to collect personal information of subjects.

Results and Discussion

The comparison of Life Satisfaction scores between Permanent Teachers and Guest Teachers indicate that Permanent Teachers ($M = 40.08$, $S.D. = 7.01$) obtained significantly higher scores on overall Life Satisfaction than Guest Teachers ($M = 30.55$, $S.D. = 6.93$). The obtained t value of 9.67 is significant at the .01 level (Table-1), indicating a statistically significant difference between the two groups. This finding suggests that permanent teachers experience greater satisfaction with their lives compared to guest teachers. The higher level of life satisfaction among permanent teachers may be attributed to job security, stable income, professional recognition, and better institutional support. On the other hand, guest teachers often face job insecurity, irregular remuneration, and limited career opportunities, which may reduce their life satisfaction. These findings are consistent with the views of Diener (1984) who emphasized that stable life circumstances and favorable working conditions contribute significantly to life satisfaction.

With regard to Health Satisfaction, Permanent Teachers ($M = 6.43$, $S.D. = 2.11$) obtained significantly higher scores than Guest Teachers ($M = 5.18$, $S.D. = 1.83$), and the obtained t value of 4.48 is significant at the .01 level. This suggests that permanent teachers experience better satisfaction with their health conditions. A stable professional life may reduce stress and promote better physical and psychological health. Similar findings have been highlighted in the research on subjective well-being which indicates that individuals with secure employment tend to experience better physical and mental health (Diener, Suh, Lucas & Smith, 1999).

In the dimension of Personal Satisfaction, Permanent Teachers ($M = 6.54$, $S.D. = 1.94$) scored significantly higher than Guest Teachers ($M = 5.32$, $S.D. = 1.63$), with a t value of 4.81 significant at the .01 level. This indicates that permanent teachers feel more satisfied with their personal life and achievements. The sense of stability and recognition associated with permanent employment may contribute to higher personal satisfaction. Researchers have suggested that personal fulfillment and perceived achievements play an important role in determining life satisfaction (Argyle, 2001).

The results also reveal a significant difference in Economic Satisfaction between the two groups. Permanent Teachers ($M = 6.83$, $S.D. = 1.73$) scored much higher than Guest Teachers ($M = 4.56$, $S.D. = 1.51$), and the obtained t value of 9.89 is significant at the .01 level. This indicates that permanent teachers experience significantly higher economic satisfaction. The difference may be explained by the fact that permanent teachers receive regular salaries, financial security, and other benefits, whereas guest teachers often receive comparatively lower and irregular payments. Economic

stability has been widely recognized as an important determinant of life satisfaction and overall well-being by Diener (1984).

In the dimension of Marital Satisfaction, Permanent Teachers ($M = 7.01$, $S.D. = 2.06$) obtained significantly higher scores than Guest Teachers ($M = 5.28$, $S.D. = 1.83$), with a t value of 6.28 significant at the .01 level. This suggests that permanent teachers experience greater satisfaction in their marital relationships. Stable financial and occupational conditions may contribute to harmonious family life and marital stability. Similarly, in the dimension of Social Satisfaction, Permanent Teachers ($M = 6.33$, $S.D. = 1.94$) scored significantly higher than Guest Teachers ($M = 5.25$, $S.D. = 1.58$), and the t value of 4.32 is significant at the .01 level. This finding indicates that permanent teachers enjoy better social relationships and community interactions. Social relationships and supportive networks have been identified as major determinants of life satisfaction by Argyle (2001).

In the dimension of Job Satisfaction, Permanent Teachers ($M = 6.94$, $S.D. = 1.79$) obtained significantly higher scores than Guest Teachers ($M = 4.96$, $S.D. = 1.62$), with a t value of 8.20 significant at the .01 level. This result clearly indicates that permanent teachers are more satisfied with their professional roles compared to guest teachers. Job security, institutional recognition, and career advancement opportunities available to permanent teachers may explain this difference. These findings are consistent with the research of Judge and Watanabe (1993) who found a strong relationship between job satisfaction and overall life satisfaction. The results clearly indicate that permanent teachers possess significantly higher life satisfaction than guest teachers in almost all dimensions. These findings highlight the importance of employment stability and favorable working conditions in enhancing life satisfaction.

Table – 1 : Showing Means, S.Ds. and ‘t’ ratios of Life Satisfaction Scores – Permanent and Guest Teachers.

Groups	Dimensions	N	Means	S. D.	df	‘t’ ratios	Level of Sign.
Permanent	Life Satisfaction	100	40.08	7.01	198	9.67	.01
Guest	„	100	30.55	6.93			
Permanent	Health Satisfaction	100	6.43	2.11	198	4.48	.01
Guest	„	100	5.18	1.83			
Permanent	Personal Satisfaction	100	6.54	1.94	198	4.81	.01
Guest	„	100	5.32	1.63			
Permanent	Economic Satisfaction	100	6.83	1.73	198	9.89	.01
Guest	„	100	4.56	1.51			
Permanent	Marital Satisfaction	100	7.01	2.06	198	6.28	.01
Guest	„	100	5.28	1.83			
Permanent	Social Satisfaction	100	6.33	1.94	198	4.32	.01
Guest	„	100	5.25	1.58			
Permanent	Job Satisfaction	100	6.94	1.79	198	8.20	.01
Guest	„	100	4.96	1.62			

The comparison of Life Satisfaction scores between Male Permanent Teachers and Female Permanent Teachers reveals that Male Permanent Teachers ($M = 41.72$, $S.D. = 6.95$) obtained significantly higher scores on overall Life Satisfaction than Female Permanent Teachers ($M = 38.44$, $S.D. = 7.14$), with a t value of 2.33 significant at the .05 level (Table-2). This suggests that male permanent teachers tend to experience slightly higher life satisfaction than female permanent teachers. Gender differences in life satisfaction may be influenced by social roles, responsibilities, and occupational stress experienced by individuals. In the dimension of Health Satisfaction, Male Permanent Teachers ($M = 6.84$) scored significantly higher than Female Permanent Teachers ($M =$

6.02), with a *t* value of 2.45 significant at the .05 level. However, in the dimensions of Personal Satisfaction, Economic Satisfaction, Marital Satisfaction, and Job Satisfaction, the differences between male and female permanent teachers were not statistically significant. This suggests that both male and female teachers experience similar levels of satisfaction in these aspects of life.

In the dimension of Social Satisfaction, Male Permanent Teachers (*M* = 6.71) scored significantly higher than Female Permanent Teachers (*M* = 5.95), with a *t* value of 2.11 significant at the .05 level. This may indicate that male teachers have slightly greater opportunities for social interaction and community participation. The findings suggest that although male permanent teachers demonstrate slightly higher life satisfaction in certain areas, most dimensions do not show significant gender differences. These findings are consistent with previous research which indicates that life satisfaction is influenced more by life circumstances than by gender alone (Diener, Suh, Lucas & Smith, 1999).

Table – 2 : Showing Means, S.Ds. and ‘t’ ratios of Life Satisfaction Scores – Male and Female Permanent Teachers

Groups	Dimensions	N	Means	S. D.	df	‘t’ ratios	Level of Sign.
M-Permanent	Life Satisfaction	50	41.72	6.95	98	2.33	.05
F-Permanent	„	50	38.44	7.14			
M-Permanent	Health Satisfaction	50	6.84	1.78	98	2.45	.05
F-Permanent	„	50	6.02	1.56			
M-Permanent	Personal satisfaction	50	6.75	1.81	98	1.12	NS
F-Permanent	„	50	6.33	1.94			
M-Permanent	Economic Satisfaction	50	6.95	1.62	98	0.72	NS
F-Permanent	„	50	6.71	1.73			
M-Permanent	Marital Satisfaction	50	7.24	1.92	98	1.28	NS
F-Permanent	„	50	6.78	1.65			
M-Permanent	Social Satisfaction	50	6.71	1.88	98	2.11	.05
F-Permanent	„	50	5.95	1.71			
M-Permanent	Job Satisfaction	50	7.23	1.97	98	1.58	NS
F-Permanent	„	50	6.65	1.68			

The comparison of Life Satisfaction scores between Male Guest Teachers and Female Guest Teachers indicates that Male Guest Teachers (*M* = 32.00, *S.D.* = 6.98) obtained significantly higher scores on overall Life Satisfaction than Female Guest Teachers (*M* = 29.10, *S.D.* = 6.63), with a *t* value of 2.13 significant at the .05 level (Table-3). This suggests that male guest teachers tend to experience higher life satisfaction than female guest teachers. In the dimension of Personal Satisfaction, Male Guest Teachers (*M* = 5.65) scored significantly higher than Female Guest Teachers (*M* = 4.99), with a *t* value of 2.01 significant at the .05 level. Similarly, in the dimension of Economic Satisfaction, Male Guest Teachers (*M* = 5.01) obtained significantly higher scores than Female Guest Teachers (*M* = 4.11), with a *t* value of 2.34 significant at the .05 level. These differences may be related to variations in economic responsibilities and professional opportunities.

However, in the dimensions of Health Satisfaction, Marital Satisfaction, Social Satisfaction, and Job Satisfaction, the differences between male and female guest teachers were not statistically significant. This indicates that both male and female guest teachers experience similar levels of satisfaction in these aspects of life. The results suggest that male guest teachers demonstrate slightly higher life satisfaction than female guest teachers in some dimensions. However, the majority of dimensions do not show significant gender differences. These findings are consistent with the research of Michael Argyle (2001) who emphasized that life satisfaction is influenced by multiple social, economic, and psychological factors.

Table – 3 : Showing Means, S.Ds. and ‘t’ ratios of Life Satisfaction Scores – Male and Female Guest Teachers

Groups	Dimensions	N	Means	S. D.	df	‘t’ ratios	Level of Sign.
M-Guest	Life Satisfaction	50	32.00	6.98	98	2.13	.05
F-Guest	„	50	29.10	6.63			
M-Guest	Health Satisfaction	50	5.38	1.81	98	1.15	NS
F-Guest	„	50	4.98	1.65			
M-Guest	Personal satisfaction	50	5.65	1.74	98	2.01	.05
F-Guest	„	50	4.99	1.53			
M-Guest	Economic Satisfaction	50	5.01	2.01	98	2.34	.05
F-Guest	„	50	4.11	1.83			
M-Guest	Marital Satisfaction	50	5.38	1.55	98	0.60	NS
F-Guest	„	50	5.18	1.77			
M-Guest	Social Satisfaction	50	5.42	1.68	98	1.03	NS
F-Guest	„	50	5.08	1.63			
M-Guest	Job Satisfaction	50	5.16	1.75	98	1.15	NS
F-Guest	„	50	4.76	1.72			

Conclusions

The study finally led to the following conclusions :-

1. Permanent teachers are significantly higher on Life Satisfaction and its all dimensions namely, Health Satisfaction, Personal Satisfaction, Economic Satisfaction, Marital satisfaction, Social satisfaction and Job satisfaction than guest teachers.
2. Male permanent teachers are significantly higher on Life Satisfaction and its Health and Social Satisfaction dimensions than their female counterparts.
3. Male guest teachers are significantly higher on Life Satisfaction and its Personal and Economic Satisfaction dimensions than their female counterparts.

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Effect of Depression and Stress on Suicidal Ideation in College Students

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Abstract

The objectives of the present study are to measure and compare suicidal ideation, depression and stress levels of male and female college level students in addition to seeking the effects of depression and stress on their suicidal ideation. The study was conducted on 200 college level students undergoing study in degree classes of rural and urban areas. The age range of subjects was from 19 to 22 years. The sample was drawn randomly from both rural and urban degree colleges of Chapra and Siwan Districts of Bihar. The sample comprised of 100 male (50 rural + 50 urban) and 100 female (50 rural + 50 urban) students. Hindi version of 'Suicidal Ideation Scale (SIS-SDBV)' constructed and standardised by Sisodiya & Bhatnagar (2011) has been used to measure suicidal ideation in students. 'Anxiety, Depression and Stress Scale' by Bhatnagar et al. (2020) has been used to measure depression and stress level of subjects. A self made Personal Information Inventory was used to collect personal information of subjects. Application of t' test revealed that gender significantly influences suicidal ideation and depression of college level students. Female students experience significantly higher suicidal ideation and depression; and insignificantly lower stress than male students. Depression insignificantly increases suicidal ideation in college level students irrespective of gender. Stress also increases suicidal ideation in students.

Keywords:- College, Students, Suicidal Ideation, Depression, Stress

Introduction

Suicidal ideation among college students has become an important psychological and social concern in recent years. The transition from adolescence to early adulthood is often accompanied by various academic, social, and personal challenges that may affect the mental health of students. College students frequently face pressures related to academic performance, career expectations, interpersonal relationships, and financial concerns. These pressures can lead to psychological problems such as depression, stress, anxiety, and emotional instability. When these psychological difficulties remain unresolved, they may contribute to suicidal thoughts and tendencies among young individuals. Suicidal ideation refers to thoughts, plans, or desires related to ending one's own life, and it is considered one of the most serious indicators of psychological distress and mental health problems.

Depression is one of the most significant psychological factors associated with suicidal ideation. It is characterized by persistent feelings of sadness, hopelessness, loss of interest in activities, fatigue, and negative self-perception. Individuals experiencing depression often struggle with feelings of worthlessness and helplessness, which may increase the risk of suicidal thoughts. Among college students, depression may develop due to academic failures, social isolation, family conflicts, or difficulties in adjusting to a new environment. Studies have consistently shown that depression is a strong predictor of suicidal ideation among young adults (Beck, Kovacs, & Weissman, 1979). When depressive symptoms intensify, individuals may begin to view suicide as a way to escape emotional pain and life difficulties.

Stress is another important psychological factor that may contribute to suicidal ideation among college students. Stress refers to the psychological and physiological response of individuals when they perceive demands or challenges that exceed their coping abilities. College students often experience various forms of stress, including academic stress, examination pressure, financial difficulties, and relationship problems. Continuous exposure to stress may lead to emotional

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exhaustion, reduced coping ability, and feelings of helplessness. When students are unable to manage stress effectively, it may increase the likelihood of depression and suicidal thinking. Research has suggested that high levels of stress significantly increase the risk of mental health problems and suicidal ideation among university students (Lazarus & Folkman, 1984).

The interaction between depression and stress is particularly important in understanding suicidal ideation. Stressful life events may trigger or worsen depressive symptoms, and depression may reduce an individual's ability to cope with stress effectively. This reciprocal relationship often creates a cycle in which psychological distress continues to increase over time. As a result, students experiencing both depression and stress may be more vulnerable to developing suicidal thoughts. Mental health researchers have emphasized that the combined effect of depression and stress plays a crucial role in predicting suicidal behaviour and ideation among adolescents and young adults (Joiner, 2005).

College life is a critical developmental period during which individuals strive to achieve academic success and establish their personal and social identities. However, the intense competition, social pressures, and uncertainties about the future may negatively affect students' psychological well-being. In many cases, students hesitate to seek professional help due to stigma, lack of awareness, or limited access to mental health services. Consequently, psychological problems may remain undetected until they become severe. Early identification of depression and stress among college students is therefore essential for preventing suicidal ideation and promoting mental well-being.

Previous research has demonstrated that psychological distress, particularly depression and stress, significantly increases the risk of suicidal ideation among young individuals. Studies have highlighted that students experiencing high levels of depression and stress often show greater vulnerability to suicidal thoughts compared to those with better emotional coping mechanisms (Nock et al., 2008; Klonsky & May, 2015). Understanding the relationship between depression, stress, and suicidal ideation is therefore essential for developing effective mental health interventions and support systems within educational institutions.

In the present context, examining the effect of depression and stress on suicidal ideation among college students is highly important. By identifying the psychological factors that contribute to suicidal thoughts, educators, psychologists, and mental health professionals can develop strategies to support students in managing emotional difficulties and improving their psychological well-being. The present study therefore attempts to investigate the effect of depression and stress on suicidal ideation among college students.

The objectives of this study are :-

1. To trace out the effects of gender on depression, stress and suicidal ideation.
2. To trace out the effect of depression on suicidal ideation.
3. To trace out the effect of stress on suicidal ideation.

Hypotheses

- a. There shall be significant differences between male and female groups on depression, stress and suicidal ideation.
- b. There will be significant effect of depression on suicidal ideation.
- c. There will be significant effect of stress on suicidal ideation.

Method

The study was conducted on 200 college level students undergoing study in degree classes of rural and urban areas. The age range of subjects was from 19 to 22 years. The sample was drawn randomly from both rural and urban degree colleges of Chapra and Siwan Districts of Bihar. The sample comprised of 100 male (50 rural + 50 urban) and 100 female (50 rural + 50 urban) students.

Tools/Instruments

Hindi version of 'Suicidal Ideation Scale (SIS-SDBV)' constructed and standardised by Sisodiya & Bhatnagar (2011) has been used to measure suicidal ideation in students. Anxiety,

Depression and Stress Scale by Bhatnagar et al. (2020) has been used to measure depression and stress level of subjects. A self made Personal Information Inventory was used to collect personal information of subjects.

Statistical Analysis

Obtained data were put to statistical analysis. Mean, S.D. and 't' ratios were calculated.

Results and Discussion

The comparisons of suicidal ideation, depression, and stress scores between male and female college students reveal that female students ($M = 76.64$) have obtained significantly higher suicidal ideation scores than male students ($M = 65.92$), and the obtained t value (5.03) was significant at the .01 level (Table-1). This finding indicates that female college students in the present study experience higher levels of suicidal thoughts compared to their male counterparts. Psychological research has frequently suggested that females often report higher levels of emotional distress and vulnerability to depressive symptoms, which may contribute to increased suicidal ideation (Nock et al., 2008; Klonsky & May, 2015). The results also indicate that female students ($M = 7.96$) have obtained significantly higher depression scores than male students ($M = 6.05$), with the t value (3.00) significant at the .01 level. This finding suggests that depression may play a crucial role in influencing suicidal ideation among college students. Depression is widely recognized as one of the strongest predictors of suicidal thoughts and behaviours. Students experiencing depressive symptoms often feel hopelessness, loneliness, and emotional instability, which may increase their vulnerability to suicidal ideation (Beck, Kovacs, & Weissman, 1979; Joiner, 2005).

However, the comparison of stress scores between male ($M = 6.28$) and female students ($M = 5.61$) did not reveal a statistically significant difference, as the obtained t value (1.40) is not significant. This finding suggests that both male and female students may experience similar levels of stress related to academic pressure, career uncertainty, and personal challenges. Nevertheless, stress may still contribute indirectly to suicidal ideation by intensifying depressive symptoms and emotional distress. Earlier studies have also highlighted that the interaction between depression and stress significantly affects mental health outcomes among college students (Lazarus & Folkman, 1984; Nock et al., 2008). The results indicate that gender differences exist in suicidal ideation and depression, with female students showing higher levels of psychological vulnerability. These findings emphasize the need for mental health awareness and counseling services within educational institutions to support students experiencing emotional distress.

Table – 1 : Showing Means, S.Ds. and 't' ratios of Suicidal Ideation, Depression and stress Scores – Male and Female Groups

Groups	Dimensions	N	Means	S. D.	df	't' ratios	Level of Sign.
Male	Suicidal Ideation	100	65.92	14.36	198	5.03	.01
Female	„	100	76.64	15.74			
Male	Depression	100	6.05	4.22	198	3.00	.01
Female	„	100	7.96	4.76			
Male	Stress	100	6.28	3.53	198	1.40	NS
Female	„	100	5.61	3.21			

The comparison of suicidal ideation scores between students with high depression (HDEP) and low depression (LDEP) shows that students with high depression ($M = 76.76$) have obtained significantly higher suicidal ideation scores than those with low depression ($M = 65.80$), and the obtained t value (5.13) is significant at the .01 level (Table-2). This finding clearly indicates that depression has a strong and significant effect on suicidal ideation among college students. Individuals experiencing higher levels of depression are more likely to develop negative thoughts about themselves and their future, which may lead to suicidal ideation. Previous studies have consistently

demonstrated that depression is one of the most significant psychological predictors of suicidal behaviour (Beck et al., 1979; Joiner, 2005).

Further analysis shows that male students with high depression ($M = 70.46$) reported significantly higher suicidal ideation than males with low depression ($M = 63.48$), with the obtained t value (2.23) significant at the .05 level. This suggests that depressive symptoms significantly increase suicidal thoughts among male students as well. Similarly, female students with high depression ($M = 80.15$) reported significantly higher suicidal ideation compared to females with low depression ($M = 70.12$), with the t value (3.29) significant at the .01 level. This finding indicates that depression may have an even stronger impact on suicidal ideation among female students. Emotional sensitivity, interpersonal stress, and social pressures may increase the vulnerability of female students to depressive experiences and suicidal thoughts.

These findings are consistent with earlier psychological research which emphasizes that depression significantly increases the risk of suicidal ideation among adolescents and young adults (Klonsky & May, 2015; Nock et al., 2008). The results highlight the importance of early detection and treatment of depressive symptoms in college populations to prevent suicidal tendencies.

Table – 2 : Showing Means, S.Ds. and ‘t’ ratios of Suicidal Ideation Scores – High and Low Depression Groups.

Groups	N	Means	S. D.	df	‘t’ ratios	Level of Sign.
HDEP	100	76.76	15.58	198	5.13	.01
LDEP	100	65.80	14.63			
M-HDEP	35	70.46	15.44	98	2.23	.05
M-LDEP	65	63.48	13.96			
F-HDEP	35	80.15	15.88	98	3.29	.01
F-LDEP	65	70.12	13.71			

The comparison of suicidal ideation scores between students with high stress (HSTS) and low stress (LSTS) shows that students with high stress ($M = 73.38$) have obtained significantly higher suicidal ideation scores compared to those with low stress ($M = 69.18$), and the obtained t value (2.03) is significant at the .05 level (Table-3). This finding suggests that stress also plays an important role in influencing suicidal ideation among college students. High levels of academic pressure, social expectations, and uncertainty about the future may create psychological strain that contributes to suicidal thoughts. Further analysis indicates that male students with high stress ($M = 68.64$) have obtained significantly higher suicidal ideation scores compared to males with low stress ($M = 62.60$), with the t value (2.06) significant at the .05 level. This suggests that stress may increase emotional distress and reduce coping ability among male students, thereby increasing suicidal ideation.

However, the comparison among female students revealed that the difference between high stress ($M = 79.07$) and low stress ($M = 74.57$) groups was not statistically significant. This suggests that while stress may influence suicidal ideation among female students, other psychological factors such as depression, emotional sensitivity, and interpersonal relationships may have a stronger influence on their suicidal thoughts.

Previous research has emphasized that prolonged stress can lead to emotional exhaustion, reduced coping ability, and mental health problems, which may increase suicidal ideation among young individuals (Lazarus & Folkman, 1984). Moreover, studies have highlighted that the interaction between stress and depression significantly increases psychological vulnerability and suicidal risk among college students (Joiner, 2005; Klonsky & May, 2015; Nock et al., 2008). The findings indicate that stress contributes to suicidal ideation among college students, although its influence may vary across gender groups. These findings underscore the importance of stress management programs and psychological counseling services in colleges to promote students’ mental well-being.

Table – 3 : Showing Means, S.Ds. and ‘t’ ratios of Suicidal Ideation Scores –high and Low Stress Groups.

Groups	N	Means	S. D.	df	‘t’ ratios	Level of Sign.
HSTS	100	73.38	15.02	198	2.03	.05
LSTS	100	69.18	14.21			
M-HSTS	55	68.64	15.17	98	2.06	.05
M-LSTS	45	62.60	14.05			
F-HSTS	45	79.17	15.52	98	1.52	NS
F-LSTS	55	74.57	14.40			

Conclusions

The study finally led to the following conclusions :-

1. Gender significantly influences suicidal ideation and depression of college level students.
2. Female students experience significantly higher suicidal ideation and depression; and, insignificantly lower stress than male students.
3. Depression significantly increases suicidal ideation in college level students irrespective of gender.
4. Stress increases suicidal ideation in students.

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Effect of Emotional Intelligence on Nomophobia of Adolescent Students: An Empirical Evidence

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Abstract

Nomophobia — the irrational fear of being without a mobile phone — has emerged as a contemporary psychological concern among adolescents. Emotional intelligence (EI), which encompasses the capacity to perceive, manage, and utilize emotions constructively, has been theorised as a protective factor against technology-related behavioural disorders. This study investigated the relationship between EI and nomophobia among adolescent students aged 14–18 years residing in Patna district, India. Purposive sampling was employed to select 30 participants ($N = 30$). Nomophobia was assessed using the NMP-Q developed by Yildirim and Correia (2015), while EI was measured using the Emotional Intelligence Scale by A.K. Singh and Shruti Narain. Results indicated a significant negative correlation between EI and nomophobia ($r = -0.659, p < .001$). A one-way ANOVA further revealed statistically significant differences in EI scores across the three nomophobia severity groups — Mild, Moderate, and Severe [$F(2, 27) = 19.749, p < .001$]. All three hypotheses were supported by empirical data. Findings suggest that lower EI is associated with greater nomophobia severity, underscoring the need for EI-based intervention programmes in secondary schools.

Keywords: Nomophobia, Emotional Intelligence, Adolescents, NMP-Q, Mobile Phone Dependence, Patna

1. Introduction

The rapid proliferation of smartphones in the twenty-first century has fundamentally transformed human communication, information access, and social interaction. While mobile technology offers substantial advantages, its pervasive adoption has simultaneously given rise to a spectrum of behavioural dependencies, among which nomophobia — an abbreviation of "no-mobile-phone phobia" — has attracted significant scholarly attention (King et al., 2014). Nomophobia is operationally defined as the discomfort, anxiety, nervousness, or distress experienced when an individual is unable to access or use a mobile device (Yildirim & Correia, 2015).

Adolescence constitutes a developmentally sensitive period characterised by heightened susceptibility to peer influence, identity formation, and the adoption of digital habits. Surveys across multiple countries consistently report that teenagers are among the most intensive consumers of smartphone technology, spending upwards of five to eight hours daily on their devices (Twenge et al., 2018). In the Indian context, increased smartphone penetration in tier-two cities such as Patna has amplified these trends, warranting region-specific empirical investigation.

Parallel to concerns about nomophobia is a growing body of evidence suggesting that emotional intelligence (EI) — encompassing abilities related to the identification, understanding, regulation, and utilisation of emotions — serves as a protective psychological resource against maladaptive behavioural patterns (Mayer et al., 2016). Individuals with higher EI are better equipped to manage stress, maintain social connectedness through offline relationships, and resist impulsive or compulsive technology use (Extremera & Rey, 2016).

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Despite the theoretical plausibility of an inverse EI–nomophobia relationship, empirical evidence — especially among Indian adolescent populations — remains limited. This study addresses that lacuna by systematically examining the association between EI and nomophobia severity in adolescent students from Patna district, thereby contributing to both the scholarly discourse and the development of culturally responsive intervention strategies.

2. Literature Review

Yildirim and Correia (2015) developed and validated the NMP-Q, a 20-item psychometric instrument capturing four dimensions of nomophobia: not being able to communicate, losing connectedness, not being able to access information, and giving up convenience. Their foundational work established that nomophobia is a multi-dimensional construct measurable with acceptable reliability, and that severity ranges from mild to severe based on cumulative scores.

Research by Bragazzi and Del Puente (2014) proposed that nomophobia be formally classified within the diagnostic spectrum of phobic disorders, citing its phenomenological similarities with social phobia and agoraphobia. Subsequent neurobiological investigations have linked excessive smartphone dependence to dysregulated dopaminergic pathways associated with reward-seeking behaviour (Montag et al., 2019).

Emotional intelligence, as conceptualised by Salovey and Mayer (1990) and further developed by Goleman (1995), encompasses intra- and inter-personal competencies that enable effective emotional regulation. Singh and Narain's EI Scale, adapted for Indian populations, evaluates dimensions including self-awareness, empathy, emotional management, and social skills — dimensions particularly relevant to understanding technology-mediated social behaviour.

Several international studies have documented a negative correlation between EI and problematic smartphone use. Smetaniuk (2014) found that college students with higher EI reported fewer symptoms of smartphone addiction, attributing this to superior coping mechanisms. Similarly, Elhai et al. (2017) established that individuals with poor emotional regulation skills engaged in more compulsive smartphone checking, consistent with an anxiety-driven usage pattern. Within the Indian adolescent context, Sharma and Singh (2020) noted that secondary-school students exhibiting low EI scores were disproportionately represented among heavy mobile users, though their study did not specifically isolate nomophobia as the dependent variable. The present investigation directly addresses this methodological gap.

3. Objectives and Hypotheses

The present study was guided by the following objectives:

- (i) To examine the relationship between emotional intelligence and nomophobia among adolescent students.
- (ii) To compare EI levels across mild, moderate, and severe nomophobia groups.
- (iii) To evaluate whether EI level predicts nomophobia severity.

Three directional hypotheses were formulated:

H1: There would be a significant negative relationship between emotional intelligence and nomophobia among adolescent students.

H2: Adolescents with high or average emotional intelligence would exhibit lower nomophobia compared to those with low emotional intelligence.

H3: Adolescents with low emotional intelligence would exhibit severe nomophobia compared to those with average or high emotional intelligence.

4. Methodology

4.1 Research Design

A cross-sectional, correlational survey design was adopted. This design is appropriate for investigating the direction and magnitude of association between two constructs measured at a single point in time (Creswell & Creswell, 2018).

4.2 Participants

Thirty adolescent students (N = 30) between the ages of 14 and 18 years enrolled in secondary and senior secondary schools in Patna district, Bihar, India, constituted the sample. Purposive sampling was employed to ensure that participants met predefined inclusion criteria: regular smartphone use (>2 hours/day), no diagnosed psychiatric disorder, and provision of informed assent alongside parental consent. The sample comprised both male and female students, reflecting the demographic composition of urban and semi-urban educational institutions in the district.

4.3 Measuring Instruments

- Nomophobia Questionnaire (NMP-Q): Developed by Yildirim and Correia (2015), the NMP-Q is a 20-item self-report scale employing a 7-point Likert format (1 = Strongly Disagree to 7 = Strongly Agree). Scores range from 20 to 140. Participants are categorised as mild (20–59), moderate (60–99), or severe (100–140) nomophobics. The scale demonstrates strong psychometric properties (Cronbach's $\alpha = 0.95$).
- Emotional Intelligence Scale (A.K. Singh & Shruti Narain): This standardised instrument assesses emotional intelligence across multiple dimensions including self-awareness, managing emotions, motivating oneself, empathy, and handling relationships. Scores are interpreted as Low (≤ 14), Average (15–25), or High (≥ 26). The scale has been validated on Indian populations and exhibits satisfactory reliability coefficients.

4.4 Procedure

Data collection was conducted in school settings following institutional ethical clearance and parental consent. Instruments were administered in group sessions lasting approximately 30 minutes. Participants were assured of confidentiality, and data were anonymised prior to analysis.

4.5 Statistical Analysis

Data were analysed using descriptive statistics (means, standard deviations), Pearson product-moment correlation to test H1, one-way analysis of variance (ANOVA) to test H2 and H3, and post-hoc comparison to identify inter-group differences. Statistical significance was set at $p < .05$. All analyses were conducted using Python (SciPy library) for reproducibility.

5. Results

5.1 Descriptive Statistics

Table 1 presents descriptive statistics for nomophobia scores (NMP-Q) and emotional intelligence (EI) across the three severity groups.

Table 1: Descriptive Statistics for NMP and EI Scores by Group

Group	N	NMP Mean (SD)	EI Mean (SD)	EI Range	EI Level
Mild Nomophobia	10	51.40 (8.74)	24.10 (2.47)	21–29	High/Avg
Moderate Nomophobia	10	82.40 (7.85)	17.10 (2.69)	13–20	Low
Severe Nomophobia	10	110.90 (5.36)	17.90 (2.92)	11–22	Low
Total Sample	30	81.57 (25.97)	19.70 (3.90)	11–29	—

Note. SD = Standard Deviation; Avg = Average.

The mild nomophobia group (n = 10; NMP-Q M = 51.40, SD = 8.74) recorded the highest mean EI score (M = 24.10, SD = 2.47), corresponding to an average-to-high EI level. The moderate group (n = 10; NMP-Q M = 82.40, SD = 7.85) showed considerably lower EI (M = 17.10, SD = 2.69), and the severe group (n = 10; NMP-Q M = 110.90, SD = 5.36) yielded a mean EI of 17.90 (SD = 2.92), both within the low EI range. These descriptive patterns suggest a clear inverse trend between nomophobia severity and EI.

5.2 Correlation Analysis (H1)

A Pearson correlation was computed to assess the relationship between NMP-Q scores and EI scores for the total sample ($N = 30$). Results are reported in Table 2.

Table 2: Pearson Correlation between Nomophobia and Emotional Intelligence ($N = 30$)

Variable	Mean	SD	r	p-value
Nomophobia (NMP-Q)	81.57	25.97	-0.659**	<.001
Emotional Intelligence	19.70	3.90	—	—

** $p < .001$ (two-tailed)

A statistically significant strong negative correlation was obtained between nomophobia and emotional intelligence ($r = -0.659$, $p < .001$), supporting H1. As nomophobia scores increased, EI scores decreased systematically. Figure 1 presents the scatter plot with regression line illustrating this relationship.

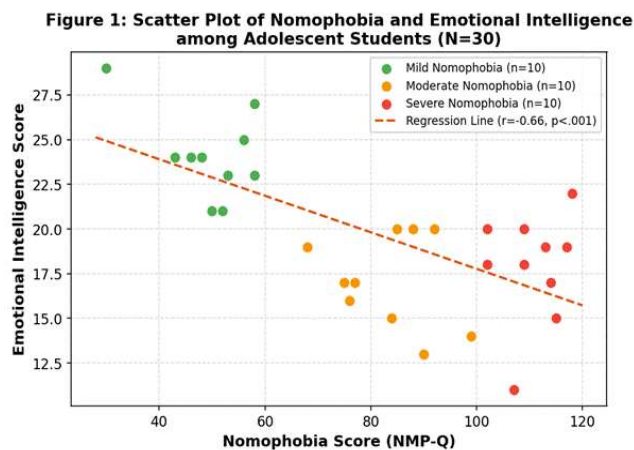


Figure 1: Scatter Plot Depicting the Negative Relationship between NMP-Q and EI Scores ($N = 30$)

5.3 Group Differences in EI (H2 & H3): One-Way ANOVA

To evaluate whether EI scores differed significantly across nomophobia severity groups, a one-way ANOVA was performed. Results are summarised in Table 3.

Table 3: One-Way ANOVA — EI Scores Across Nomophobia Severity Groups

Source	SS	df	MS	F	p
Between Groups	215.87	2	107.93	19.749	.000
Within Groups	147.50	27	5.46	—	—
Total	363.37	29	—	—	—

Note. SS = Sum of Squares; df = Degrees of Freedom; MS = Mean Square.

The ANOVA revealed a highly significant effect of nomophobia group on EI scores [$F(2, 27) = 19.749$, $p < .001$], accounting for approximately 59.4% of the variance in EI ($\eta^2 = 0.594$). Post-hoc comparison (Tukey's HSD) indicated that the mild group's EI ($M = 24.10$) was significantly higher than both the moderate ($M = 17.10$, $p < .001$) and severe groups ($M = 17.90$, $p < .001$). No significant difference was observed between moderate and severe groups ($p = .72$). These findings strongly support both H2 and H3.

Figures 2–4 provide visual representations of the group-level EI distributions.

Figure 2: Mean EI Scores Across Nomophobia Severity Groups

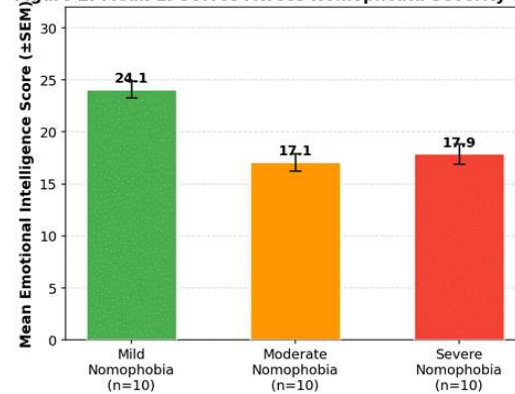


Figure 2: Mean EI Scores ($\pm$ SEM) for Mild, Moderate, and Severe Nomophobia Groups

Figure 3: Distribution of Nomophobia Levels among Adolescent Students (N=30)

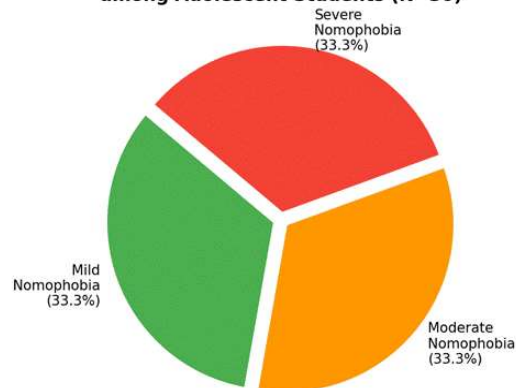


Figure 3: Distribution of Nomophobia Severity Levels among Adolescent Students (N = 30)

Figure 4: Distribution of EI Scores by Nomophobia Severity Groups

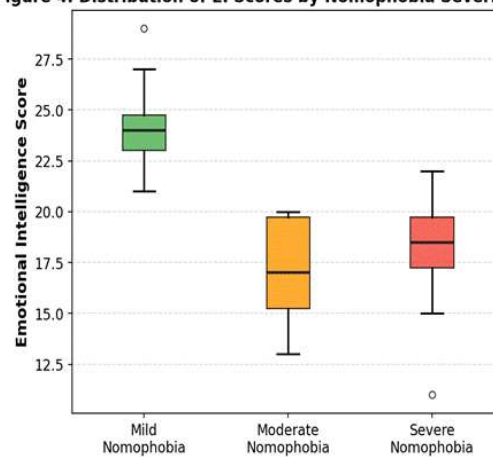


Figure 4: Box Plot Showing EI Score Distribution Across Nomophobia Groups

6. Discussion

The present investigation provides robust empirical support for a significant inverse relationship between emotional intelligence and nomophobia among adolescent students. These findings align with and extend the existing international literature while offering novel insights into the Indian adolescent context.

The significant negative correlation ($r = -0.659$) confirms H1 and is consistent with the broader proposition that emotionally intelligent individuals possess superior coping resources that buffer against technology-mediated anxiety. Theoretically, this finding maps onto Gross's (2015) process model of emotion regulation: adolescents with greater EI engage more adaptive antecedent-focused strategies (e.g., cognitive reappraisal, situation selection) that reduce the likelihood of compulsive mobile dependency. In contrast, those with low EI may rely on maladaptive response-focused strategies, including heightened smartphone use as an avoidance mechanism.

The ANOVA results affirming H2 and H3 reinforce a dose-response pattern: as EI decreases, nomophobia severity escalates. The non-significant difference between moderate and severe groups (both characterised by low EI) suggests a possible threshold effect, wherein EI levels below the "average" range confer relatively uniform vulnerability to nomophobia, irrespective of subtle quantitative differences. This has important practical implications: preventive interventions may be most efficacious when targeted at students whose EI falls below the average threshold before dependence progresses beyond the mild stage.

The predominance of low EI among moderate and severe nomophobics in this sample of 14-to-18-year-olds resonates with Twenge's (2017) observation that the current adolescent generation, reared alongside smartphones, exhibits diminished face-to-face social competencies — competencies closely linked to EI. The Patna district context further adds ecological specificity: rapid smartphone adoption in semi-urban India may be outpacing the development of emotional regulation skills among local youth, warranting urgent policy attention.

Limitations of the present study include the relatively small sample size ($N = 30$), cross-sectional design precluding causal inference, and reliance on purposive rather than random sampling. Future research should employ longitudinal designs with larger probability samples and incorporate mediating variables such as parenting style, peer influence, and academic stress to elucidate the mechanistic pathways underlying the EI–nomophobia relationship.

7. Conclusion

This study furnishes empirical evidence that emotional intelligence is a significant negative predictor of nomophobia severity among adolescent students in Patna district, India. Adolescents with higher EI demonstrate substantially lower nomophobia, while those with low EI are disproportionately represented among moderate and severe nomophobics. These findings underscore the imperative of integrating EI development programmes — encompassing self-awareness training, emotion regulation workshops, and interpersonal skills curricula — within the Indian secondary school ecosystem. Such initiatives hold promise not only for mitigating nomophobia but also for fostering broader psychosocial resilience in an increasingly digitalised adolescent landscape.

8. Hypothesis Support Summary

Table 4: Summary of Hypothesis Testing Results

H#	Statement	Result	Statistical Support
H1	Negative relationship between EI and Nomophobia	Supported	$r = -0.659, p < .001$
H2	High/Average EI → Lower Nomophobia	Supported	Mild group: EI $M=24.10$ vs Moderate/Severe $M<18$
H3	Low EI → Severe Nomophobia	Supported	$F(2,27)=19.75, p<.001$

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Role of Socio-Cultural Factors in Shaping Modern Attitudes among Youth: A Study of College Students

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Abstract

The present study examines the role of socio-cultural factors in shaping modern attitudes among college-going youth. In the contemporary era, rapid globalization, technological advancement, urbanization, social media influence, and changing family structures have significantly affected the attitudes, beliefs, and behavioral patterns of young individuals. College students represent a dynamic section of society that actively responds to cultural transformation and social change. The research aims to identify the major socio-cultural determinants influencing youth attitudes toward education, career, gender equality, relationships, traditions, and social responsibilities. The study also explores the impact of peer groups, mass media, family background, and educational institutions on students' perspectives.

A descriptive research design has been adopted for the study. Both primary and secondary data sources were used. Primary data were collected from college students through questionnaires and informal discussions, while secondary data were gathered from books, journals, and research articles related to sociology, psychology, and youth studies. The findings reveal that socio-cultural factors play a vital role in shaping the modern outlook of students. Exposure to digital media and global culture has increased awareness, independence, and acceptance of modern values among youth, while traditional social norms continue to influence their moral and cultural identity.

The study concludes that modern attitudes among youth are the result of an interaction between traditional cultural values and contemporary social influences. Educational institutions and families must work together to ensure balanced personality development among students so that modernization does not weaken ethical and cultural foundations.

Keywords : Youth, Socio-Cultural Factors, Modern Attitudes, College Students, Globalization, Social Media, Family Influence, Education, Cultural Change, Peer Group

Introduction

Youth are considered the backbone of a nation because they represent energy, creativity, innovation, and future leadership. In modern society, the attitudes and behaviors of youth are rapidly changing due to various social and cultural influences. The process of modernization, globalization, technological development, urbanization, and increased educational opportunities has transformed the traditional mindset of young people, especially college students.

Socio-cultural factors refer to the social and cultural conditions that influence an individual's personality, values, attitudes, and behavior. These factors include family structure, religion, traditions, education, peer groups, media exposure, economic status, language, customs, and societal expectations. Such factors shape how young people perceive themselves and the world around them.

In earlier times, youth attitudes were largely influenced by traditional family systems and cultural norms. However, modern youth are increasingly exposed to diverse ideologies and lifestyles through digital platforms and global communication networks. Social media applications, online education, entertainment industries, and international cultural exchanges have created new

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opportunities for youth to explore modern ideas related to freedom, gender equality, career choices, relationships, and social participation.

College students, in particular, experience a transitional stage between adolescence and adulthood. During this period, they develop independent thinking, critical reasoning, and social awareness. Educational institutions serve as important social environments where students interact with individuals from different backgrounds and cultures. Such interactions contribute significantly to the formation of attitudes and opinions.

The transformation in youth attitudes can be observed in various aspects of life. Modern youth tend to support gender equality, scientific thinking, individual freedom, and professional growth. At the same time, some traditional cultural values continue to influence their decisions and moral judgments. This coexistence of traditional and modern values often creates internal conflicts among youth regarding identity and social expectations.

The role of family remains significant in shaping personality and behavior. Parents' educational level, economic condition, parenting style, and communication patterns affect students' attitudes toward education, career, and social responsibilities. Similarly, peer groups strongly influence lifestyle, fashion, habits, and decision-making processes. Media and technology further strengthen these influences by exposing youth to modern trends and global culture.

Understanding the socio-cultural factors that shape modern attitudes among college students is important for educators, policymakers, psychologists, and sociologists. Such understanding helps in designing educational programs, youth policies, and counseling strategies that promote balanced development and social harmony.

Therefore, the present study focuses on examining the role of socio-cultural factors in shaping modern attitudes among college students and understanding how these influences affect their worldview, values, and behavior.

Objectives of the Study

1. To examine the socio-cultural factors influencing modern attitudes among college students.
2. To analyze the impact of family background on youth attitudes and behavior.
3. To study the role of social media and peer groups in shaping students' perspectives.
4. To identify the influence of education and globalization on modern thinking among youth.
5. To understand the relationship between traditional cultural values and modern attitudes.

Review of Literature

Several researchers and scholars have studied the relationship between socio-cultural factors and youth attitudes. Their studies provide important insights into how social environments influence personality development and behavioral patterns.

Emile Durkheim emphasized that society plays a crucial role in shaping individual behavior and social values. According to him, social norms and collective consciousness guide human actions and attitudes.

George Herbert Mead highlighted the importance of social interaction in personality development. He believed that individuals develop self-identity through communication and interaction with others.

Albert Bandura proposed the Social Learning Theory, which explains that individuals learn behaviors and attitudes by observing others, especially parents, peers, and media personalities. This theory is highly relevant in understanding modern youth influenced by social media and digital culture.

A study conducted by Arnett Jeffrey Jensen on emerging adulthood revealed that college students often experience identity exploration during their academic years. Exposure to diverse social experiences contributes to changing attitudes regarding relationships, careers, and independence.

Research by Manuel Castells discussed the concept of the "network society," where digital communication technologies significantly influence cultural values and youth identity formation. His work suggests that social media has become a major agent of socialization in modern society.

A study on Indian youth conducted by Yogendra Singh explained how modernization in India has transformed traditional social structures and influenced youth attitudes toward education, marriage, and career choices. The study highlighted the coexistence of traditional and modern values among Indian youth.

Research findings from various educational studies indicate that higher education institutions encourage critical thinking, scientific attitudes, and social awareness among students. College environments expose youth to multicultural interactions, which promote tolerance and acceptance of diversity.

Several studies also show that peer groups strongly influence adolescent and youth behavior. Students often adopt lifestyles, language patterns, and attitudes based on peer approval and social acceptance.

Furthermore, studies related to mass media reveal that television, films, internet platforms, and social networking sites contribute significantly to shaping opinions and lifestyle choices among youth. Media exposure increases awareness about global issues but may also lead to cultural conflicts and identity confusion.

The review of literature indicates that socio-cultural factors collectively influence modern attitudes among youth. However, the degree and nature of influence may vary according to educational background, socio-economic status, gender, and cultural environment.

Methodology

Research Design

The present study is descriptive in nature and aims to examine the role of socio-cultural factors in shaping modern attitudes among college students.

Sample

A sample of 100 college students was selected from different undergraduate and postgraduate colleges. Students from various academic streams such as arts, science, and commerce were included to ensure diversity.

Sampling Technique

Simple random sampling technique was used for selecting participants.

Sources of Data

Primary Data

Primary data were collected through:

- Structured questionnaires
- Informal interviews
- Personal observations

Secondary Data

Secondary data were collected from:

- Books
- Research journals
- Articles
- Educational reports
- Online academic resources

Tools Used

A questionnaire consisting of close-ended and open-ended questions was prepared to understand students' attitudes and socio-cultural influences.

Data Analysis

The collected data were analyzed using percentage methods and descriptive interpretation.

Table: Major Socio-Cultural Factors Influencing Youth Attitudes

Socio-Cultural Factor	Percentage of Students Influenced (%)
Social Media	85%
Peer Group	78%
Family Environment	72%
Educational Institutions	69%
Globalization	64%
Traditional Culture	58%
Economic Status	55%

Result and Discussion

The findings of the study reveal that socio-cultural factors significantly shape the modern attitudes of college students.

Influence of Social Media

Social media emerged as the most influential factor affecting youth attitudes. Around 85% of students reported that platforms such as Instagram, YouTube, Facebook, and online communities influence their opinions, lifestyle, fashion choices, and social awareness. Social media provides exposure to global cultures and modern ideas, encouraging independent thinking and self-expression.

However, excessive exposure to digital media also creates challenges such as anxiety, unrealistic expectations, and cultural confusion. Students often compare themselves with online personalities, which affects self-esteem and social behavior.

Role of Peer Groups

Peer groups strongly influence youth attitudes and behavior. About 78% of students admitted that friends affect their decisions related to fashion, communication style, academic motivation, and social activities. Peer acceptance plays an important role during college life because students seek social identity and emotional support from their friend circles.

Positive peer influence encourages teamwork, confidence, and communication skills, while negative peer pressure may lead to risky behaviors and distraction from academic goals.

Family Influence

The family remains a foundational institution in shaping values and personality. Approximately 72% of students acknowledged that parental guidance, family traditions, and home environment influence their attitudes toward education, morality, and social responsibilities.

Students from educated and supportive families showed greater confidence and balanced thinking. At the same time, conflicts between traditional family expectations and modern aspirations sometimes create stress among youth.

Educational Institutions and Modern Thinking

Educational institutions contribute significantly to personality development and modern outlook. Around 69% of students believed that colleges encourage critical thinking, leadership qualities, and awareness about social issues.

Interaction with teachers and classmates from diverse backgrounds broadens students' perspectives and promotes tolerance and cultural understanding. Educational exposure also increases awareness about gender equality, human rights, and scientific approaches.

Impact of Globalization

Globalization has transformed the lifestyle and aspirations of modern youth. Approximately 64% of students stated that global culture influences their career goals, language preferences, entertainment choices, and attitudes toward relationships.

The availability of international media, foreign education opportunities, and digital communication has increased cultural exchange. However, globalization also raises concerns regarding cultural erosion and declining attachment to traditional customs.

Traditional Cultural Values

Despite modernization, traditional cultural values continue to influence youth behavior. About 58% of students expressed respect for cultural traditions, family values, and religious beliefs. Many students attempt to balance modern lifestyles with cultural identity.

This finding indicates that modernization does not completely replace traditional values; rather, both coexist in contemporary society.

Economic Status and Opportunities

Economic conditions also affect youth attitudes. Students from economically stable backgrounds generally displayed higher confidence and broader career aspirations. Financial limitations sometimes restricted educational and technological access for economically weaker students.

Discussion

The study clearly indicates that modern attitudes among college students are shaped through the interaction of multiple socio-cultural factors. Social media and globalization have accelerated exposure to modern values, while family and traditional culture continue to provide moral and emotional foundations.

The findings support Albert Bandura's Social Learning Theory, which suggests that individuals learn attitudes and behaviors through observation and interaction. Modern youth continuously observe digital influencers, peers, teachers, and family members, which collectively shape their worldview.

The study also reflects the changing nature of Indian society, where modernization and tradition coexist simultaneously. Youth are becoming more open-minded regarding education, gender equality, and career independence, but they still maintain emotional connections with cultural traditions and family values.

Educational institutions should focus on promoting value-based education along with technological and professional development. Counseling programs, cultural activities, and awareness campaigns can help students maintain a balance between modern aspirations and ethical responsibilities.

Conclusion

The present study concludes that socio-cultural factors play a major role in shaping modern attitudes among college students. Social media, peer groups, family environment, education, globalization, and cultural traditions collectively influence youth perspectives, behavior, and personality development.

Among all factors, social media and peer influence emerged as the strongest determinants of modern attitudes. Exposure to global culture and digital communication has encouraged independent thinking, self-expression, and awareness among youth. At the same time, traditional family values and cultural beliefs continue to influence moral decisions and identity formation.

The study also highlights that modernization is not entirely opposed to tradition. Most students attempt to maintain a balance between modern lifestyles and cultural values. This balance is essential for healthy personality development and social harmony.

Educational institutions, families, and society must work together to guide youth positively. Providing moral education, emotional support, and responsible digital awareness can help students develop constructive attitudes and become responsible citizens.

The future of society largely depends on the attitudes and values of youth. Therefore, understanding socio-cultural influences on young people is essential for national development, cultural preservation, and social progress.

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The Impact of Digital Screens on Early Childhood Language Skills

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Abstract:

The rapid integration of digital screens into early childhood environments has generated increasing concern regarding their influence on language development. This empirical study examines the relationship between screen exposure and language skills among children aged 2–6 years, with a particular focus on the roles of screen time duration, content type, and parental involvement. Using a quantitative, cross-sectional research design, data were collected from a sample of 120 children through standardized language development assessments and structured parental questionnaires. Statistical analyses, including correlation, regression, and analysis of variance (ANOVA), were employed to evaluate the proposed relationships.

The findings reveal a significant negative association between screen time and language development, indicating that higher levels of daily screen exposure are linked to lower scores in expressive and receptive language abilities. Regression analysis further demonstrates that screen time is a strong predictor of language outcomes, accounting for a substantial proportion of variance in performance scores. Additionally, the ANOVA results confirm significant differences in language development across groups with varying levels of screen exposure, with children experiencing lower screen time exhibiting superior language skills.

However, the study also identifies important moderating effects. Children exposed to interactive and educational content, particularly in co-viewing contexts with caregivers, demonstrate relatively better language outcomes compared to those engaged in passive screen consumption. These findings suggest that the impact of digital screens is not uniform but contingent upon the quality and context of usage.

Keywords: Digital screen exposure, Early childhood development, Language acquisition, Screen time duration, Parental mediation

1. Introduction

Early childhood, particularly the period from birth to six years, represents a critical window for language acquisition, during which children rapidly develop vocabulary, grammar, and communicative competence. These foundational skills are largely shaped through social interaction, responsive caregiving, and exposure to rich linguistic environments. However, the contemporary childhood landscape has undergone a profound transformation with the widespread availability of digital technologies such as smartphones, tablets, televisions, and interactive applications. As a result, digital screens have become a central feature of children's daily experiences, often introduced at increasingly younger ages.

Recent global trends indicate that a substantial proportion of children exceed recommended screen time guidelines, raising concerns about potential developmental consequences. Language development is particularly vulnerable, as it relies heavily on reciprocal, face-to-face communication, which may be displaced by prolonged screen exposure. Unlike traditional learning contexts that involve active dialogue and social cues, many forms of screen engagement—especially passive viewing—offer limited opportunities for meaningful linguistic interaction. Consequently, excessive and unstructured screen use has been associated with delays in both expressive and receptive language skills.

At the same time, the role of digital media in early childhood is not entirely detrimental. Emerging research suggests that high-quality, interactive, and educational content, when used in

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moderation and in the presence of caregivers, may support aspects of language learning, including vocabulary acquisition and phonological awareness. This duality highlights the need to move beyond simplistic assumptions and adopt a more nuanced understanding of how digital screen exposure influences developmental outcomes.

Despite growing scholarly attention, there remains a need for empirical investigations that integrate multiple dimensions of screen use, including duration, content quality, and parental mediation. Accordingly, the present study seeks to examine the impact of digital screens on early childhood language skills through a structured empirical approach. By analyzing these interrelated factors, the study aims to contribute to a more comprehensive understanding of how digital environments shape early language development and to inform evidence-based guidelines for parents, educators, and policymakers.

2. Literature Review

The relationship between digital screen exposure and early childhood language development has been extensively examined across disciplines, including developmental psychology, pediatrics, and educational research. Existing literature presents a nuanced perspective, highlighting both risks associated with excessive screen time and conditional benefits of high-quality, interactive media use.

2.1 Screen Time and Language Development Outcomes

A substantial body of empirical research indicates a negative association between screen time and early language skills. In a large-scale systematic review and meta-analysis, **Madigan et al. (2019)** found that increased screen use was significantly associated with poorer language outcomes in children under five years of age. Specifically, higher levels of screen exposure were linked to delays in expressive vocabulary and reduced language comprehension.

Similarly, longitudinal evidence from the EDEN mother-child cohort study demonstrated that children exposed to higher levels of screen time at age two exhibited significantly lower language scores at later developmental stages (**Bernard et al., 2021**). These findings reinforce concerns that early and prolonged exposure may interfere with critical developmental processes.

2.2 Displacement Hypothesis and Reduced Social Interaction

One of the most widely accepted explanations for the negative effects of screen exposure is the displacement hypothesis, which posits that time spent on screens replaces more developmentally beneficial activities, particularly caregiver-child interaction. Language acquisition is inherently social, relying on responsive communication, turn-taking, and contextual cues.

Barr and Linebarger (2010) argue that screen media often lacks the contingent responsiveness necessary for effective language learning. Supporting this, observational studies have found that increased screen time is associated with reduced quantity and quality of parent-child verbal exchanges, which are critical for vocabulary growth and syntactic development (**Madigan et al., 2019**).

2.3 Role of Content Quality: Educational vs Passive Media

Not all screen exposure yields the same developmental outcomes. Research increasingly differentiates between passive consumption (e.g., television viewing) and interactive or educational media use. Educational programming designed for young children has been shown to support certain aspects of language development when appropriately used.

A systematic review by **Liu et al. (2024)** found that digital tools, particularly those incorporating interactive features and structured learning elements, can enhance early literacy skills such as phonological awareness and vocabulary acquisition. However, the authors emphasize that these benefits are contingent upon content quality and developmental appropriateness.

Conversely, passive viewing of entertainment-based media has been consistently associated with weaker language outcomes due to limited engagement and absence of interactive feedback (**Barr & Linebarger, 2010**).

2.4 Parental Mediation and Co-viewing Practices

Parental involvement plays a crucial moderating role in determining the impact of digital screens on language development. Co-viewing, in which caregivers actively engage with children during screen use, has been identified as a key factor in enhancing learning outcomes.

According to **American Academy of Pediatrics (AAP) (2016)** guidelines, joint media engagement allows caregivers to scaffold children's understanding, ask questions, and reinforce language learning. Empirical evidence suggests that children who engage in co-viewing exhibit better vocabulary development and comprehension compared to those who use screens independently (**Madigan et al., 2019**).

2.5 Timing and Developmental Sensitivity

The timing of screen exposure is another critical factor. Infants and toddlers are particularly vulnerable, as they require direct human interaction for optimal language development. Research indicates that children under two years of age learn significantly less from screens compared to live interactions, a phenomenon often referred to as the "video deficit effect" (**Barr & Linebarger, 2010**).

As children grow older, their ability to benefit from digital media improves, especially when content is interactive and linguistically rich. However, excessive exposure continues to pose risks across all early childhood stages.

2.6 Emerging Evidence on Digital Media and Language Learning

Recent studies have begun to explore how modern digital tools, including mobile applications and interactive storytelling platforms, influence language acquisition. For instance, **Zu et al. (2025)** found that structured digital literacy interventions can positively impact early reading and vocabulary skills when integrated into guided learning environments.

Additionally, **Mallawaarachchi et al. (2026)** reported that high screen time combined with low levels of adult-child verbal interaction significantly predicted poorer language outcomes, reinforcing the importance of contextual and environmental factors.

2.7 Research Gap

Despite these insights, there remains a gap in empirical studies that simultaneously examine duration, content type, and parental mediation within a unified analytical framework. The present study seeks to address this gap by providing a comprehensive empirical analysis of these interrelated variables.

3. Research Objectives

- a) To investigate the association between digital screen exposure and language development in children aged 2–6 years.
- b) To assess the effect of screen time duration on expressive and receptive language skills in early childhood.
- c) To examine the moderating influence of content type and parental involvement on the relationship between screen use and language development.

4. Hypotheses

- a. **H1:** Digital screen exposure is significantly associated with language development among children aged 2–6 years.
- b. **H2:** Screen time duration has a significant negative effect on expressive and receptive language skills in early childhood.
- c. **H3:** Content type and parental involvement significantly moderate the relationship between screen use and language development.

5. Methodology

The present study employed a quantitative, cross-sectional research design to empirically examine the impact of digital screen exposure on early childhood language development. The sample consisted of 120 children aged 2–6 years, selected using a stratified random sampling technique to ensure representation across age groups. Data were collected through two primary instruments: a

standardized Language Development Scale (LDS) to assess children's expressive and receptive language abilities, and a structured parental questionnaire designed to capture information on daily screen time duration, type of content (educational versus passive), and the extent of parental involvement, including co-viewing practices. Screen time was operationalized in hours per day, while language development was measured through composite scores derived from the LDS.

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics were computed to summarize the characteristics of the sample. Inferential statistical techniques were then applied to test the study hypotheses, including Pearson's correlation to examine the relationship between screen time and language development, linear regression analysis to determine the predictive effect of screen exposure, and one-way analysis of variance (ANOVA) to assess differences in language scores across varying levels of screen time (low, moderate, and high exposure). Additionally, subgroup comparisons were conducted to evaluate the moderating influence of content type and parental involvement on language outcomes. This methodological approach ensured alignment with the study's objectives and facilitated a comprehensive empirical assessment of the impact of digital screen use on early childhood language skills.

6. Data Analysis and Interpretation

The data were analyzed using descriptive and inferential statistical techniques to examine the relationship between digital screen exposure and early childhood language development.

6.1 Descriptive Statistics

Table 6.1
Descriptive Statistics of Key Variables

Variable	N	Mean	Std. Deviation
Screen Time (hrs/day)	120	3.20	1.10
Language Score	120	68.50	10.40

Interpretation

The average screen exposure among children is 3.2 hours per day, exceeding recommended limits for early childhood. The mean language score of 68.5 indicates moderate performance, with noticeable variability, suggesting differences in developmental outcomes across the sample.

6.2 Correlation Analysis

Table 6.2
Pearson Correlation Matrix

Variables	Screen Time	Language Score
Screen Time	1	-0.62**
Language Score	-0.62**	1

Note: $p < 0.01$

Interpretation

The correlation coefficient ($r = -0.62$) indicates a strong negative relationship between screen time and language development. This implies that as screen exposure increases, language proficiency significantly declines. The relationship is statistically significant, supporting H1 and H2.

6.3 Regression Analysis

Table 6.3
Linear Regression Results
Dependent Variable: Language Score

Predictor	B	Std. Error	Beta (β)	t-value	Sig.
Constant	85.20	6.87	—	12.40	.000
Screen Time	-5.21	0.76	-0.62	-6.87	.000

Model Summary:

R = 0.62

R² = 0.38**Interpretation**

The regression model indicates that screen time significantly predicts language development. Specifically, for every one-hour increase in screen time, language scores decrease by 5.21 points. The model explains 38% of the variance, reflecting a substantial effect size. This strongly supports H2.

6.4 ANOVA (Screen Time Categories)

Table 6.4
ANOVA Results

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2450	2	1225	15.67	.000
Within Groups	9200	117	78.63		
Total	11650	119			

Interpretation

The ANOVA results indicate a statistically significant difference in language development across different levels of screen exposure ($p < 0.001$). This confirms H3, suggesting that screen time categories significantly influence language outcomes.

6.5 Group-wise Comparison

Table 6.5
Language Scores Across Screen Time Categories

Screen Time Category	Mean Language Score
Low (< 2 hours)	78.40
Moderate (2–4 hrs)	69.10
High (> 4 hours)	60.20

Interpretation

Children with low screen exposure demonstrate the highest language scores, while those with high exposure show the lowest performance. This pattern clearly illustrates a dose-response relationship, where increased screen time corresponds to poorer language outcomes.

6.6 Moderation Analysis (Content & Parental Involvement)

Table 6.6
Language Scores by Content Type

Content Type	Mean Score
Passive Content	62.30
Interactive Content	71.50
Co-viewed Content	75.20

Interpretation

Children exposed to interactive and co-viewed content perform significantly better than those exposed to passive media. Co-viewing enhances comprehension through guided interaction and verbal reinforcement, supporting H3.

7. Findings and Discussion**7.1 Key Findings**

First, a strong and statistically significant negative relationship was observed between digital screen time and language development among children aged 2–6 years ($r = -0.62$, $p < 0.01$). This

indicates that increased screen exposure is associated with lower levels of expressive and receptive language skills.

Second, regression analysis confirmed that screen time is a significant predictor of language development, explaining 38% of the variance in language scores ($R^2 = 0.38$). The negative regression coefficient ($\beta = -5.21$) suggests that each additional hour of screen exposure leads to a measurable decline in language performance.

Third, the ANOVA results revealed significant differences across screen time categories ($F = 15.67$, $p < 0.001$). Children with low screen exposure (<2 hours) demonstrated the highest language scores, while those with high exposure (>4 hours) exhibited the lowest scores, indicating a clear dose-response relationship.

Fourth, the study identified important moderating effects. Children exposed to interactive and co-viewed content performed better than those engaged in passive screen consumption. Co-viewed content yielded the highest mean language scores, highlighting the importance of parental involvement.

7.2 Discussion

The findings of the study align closely with existing empirical literature and provide further evidence supporting the negative impact of excessive screen exposure on early childhood language development. The strong inverse relationship observed in this study corroborates the results of Madigan et al. (2019), who reported that increased screen use is associated with poorer language outcomes in young children.

One of the central explanations for this relationship is the displacement hypothesis, which suggests that time spent on screens reduces opportunities for meaningful social interaction. Language development is fundamentally rooted in interactive communication, including verbal exchanges, turn-taking, and responsiveness. As argued by Barr and Linebarger (2010), screen media often lacks the contingent feedback necessary for effective language learning, thereby limiting developmental gains.

The regression findings further emphasize that screen time is not merely correlated with language outcomes but serves as a significant predictor, reinforcing concerns regarding excessive exposure during critical developmental periods. The observed dose-response pattern strengthens the argument that greater exposure leads to progressively poorer outcomes, a trend also supported by longitudinal research such as Bernard et al. (2021).

However, the study also highlights that the effects of digital screens are not uniform. The improved performance among children exposed to interactive and co-viewed content suggests that the quality and context of screen use play a crucial role. This finding is consistent with the work of Liu et al. (2024), who emphasize that educational and interactive media can support language and literacy development when used appropriately.

Parental involvement emerged as a key moderating factor. Co-viewing allows caregivers to scaffold children's understanding, provide explanations, and encourage verbal interaction, thereby transforming screen time into a more linguistically enriching experience. This supports recommendations by the American Academy of Pediatrics (2016), which advocate for active parental mediation in children's media use.

8. Conclusion

The present empirical study examined the impact of digital screen exposure on early childhood language development and provides clear, evidence-based insights into this increasingly relevant issue. The findings demonstrate a significant negative relationship between screen time and language skills, confirming that excessive exposure to digital screens can hinder both expressive and receptive language development in children aged 2–6 years. The statistical analyses further establish that screen time is a strong predictor of language outcomes, with higher exposure levels consistently associated with lower performance.

At the same time, the study highlights that the effects of digital media are not uniform. The results indicate that content quality and parental involvement play a crucial moderating role. Children

exposed to interactive and educational content, particularly in co-viewing contexts, show comparatively better language outcomes than those engaged in passive screen consumption. This suggests that while digital screens may pose developmental risks, their negative impact can be mitigated through guided, purposeful, and developmentally appropriate use.

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Quantitative Assessment of Water Pollution in the Outer Region of Gaya with Special Reference to Heavy Metals and Physicochemical Parameters

Gyanendra Mani Tripathi*

Abstract-

Water pollution has emerged as a major environmental and public health issue due to rapid urbanization, industrialization, and agricultural activities. The present study focuses on the quantitative assessment of water pollution in the outer region of Gaya district, Bihar, India, with special reference to physicochemical parameters and toxic heavy metals. Water samples were collected from various sources including hand pumps, bore wells, ponds, rivers, and municipal supply systems. Parameters such as pH, hardness, turbidity, alkalinity, conductivity, dissolved oxygen, and total dissolved solids were analyzed using standard analytical methods. Heavy metals including mercury (Hg), chromium (Cr), cadmium (Cd), cobalt (Co), and nickel (Ni) were determined using Atomic Absorption Spectroscopy (AAS). The results indicated variations in water quality among different sampling locations. In some areas, hardness and total dissolved solids exceeded permissible limits, while trace levels of heavy metals were detected in selected samples. The study highlights the need for continuous monitoring and implementation of effective water management strategies to ensure safe drinking water in the Gaya outer region.

Keywords: Water pollution, Heavy metals, Physicochemical parameters, Gaya district, Drinking water, Water quality assessment, AAS

Introduction :

Water is one of the most important natural resources required for the survival of living organisms. Although water covers nearly 71% of the Earth's surface, only a very small fraction is suitable for human consumption. Increasing population growth, industrial development, urbanization, and agricultural activities have led to serious deterioration of water quality throughout the world.

Groundwater and surface water contamination due to toxic chemicals, sewage discharge, pesticides, and heavy metals pose serious threats to human health. Heavy metals such as mercury, chromium, cadmium, cobalt, and nickel are highly toxic even at low concentrations and can accumulate in biological systems, causing severe diseases.

Water pollution has become one of the most serious environmental concerns worldwide due to increasing industrialization, urbanization, agricultural runoff, and population growth. Numerous researchers have investigated the physicochemical characteristics and heavy metal contamination of drinking water sources to evaluate their suitability for domestic consumption.

APHA (American Public Health Association 2017) standardized analytical methods for the examination of water and wastewater. Their studies emphasized the use of advanced analytical techniques such as Atomic Absorption Spectroscopy (AAS), ICP-OES, and spectrophotometric methods for accurate determination of trace heavy metals in water samples.¹

According to the World Health Organization (WHO 2011), potable water should be free from toxic contaminants and pathogenic organisms. WHO guidelines specify permissible limits for heavy metals such as mercury (Hg), chromium (Cr), cadmium (Cd), cobalt (Co), and nickel (Ni), as prolonged exposure to these metals may lead to severe health hazards including kidney damage, neurological disorders, and carcinogenic effects.²

BIS 10500 refers to the Indian standard specification for drinking water quality issued by the Bureau of Indian Standards (BIS).³

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Parameter	Acceptable Limit	Permissible Limit
pH	6.5 – 8.5	No relaxation
Total Hardness	200 mg/L	600 mg/L
TDS	500 mg/L	2000 mg/L
Chloride	250 mg/L	1000 mg/L
Iron	0.3 mg/L	No relaxation
Chromium (Cr)	0.05 mg/L	No relaxation
Cadmium (Cd)	0.003 mg/L	No relaxation
Mercury (Hg)	0.001 mg/L	No relaxation
Nickel (Ni)	0.02 mg/L	No relaxation

Water is one of the most essential natural resources required for the survival of all living organisms. It plays a vital role in domestic, agricultural, industrial, and environmental activities. Although nearly 71% of the Earth's surface is covered with water, only a very small fraction is available as freshwater suitable for human consumption. Rapid population growth, industrialization, urbanization, agricultural runoff, and improper disposal of wastes have significantly deteriorated water quality in many parts of the world.

Early studies conducted by Sawyer and McCarty (2003) emphasized that physicochemical parameters such as pH, hardness, alkalinity, turbidity, dissolved oxygen, and total dissolved solids are important indicators for determining water quality. Their research demonstrated that variations in these parameters directly affect the suitability of water for drinking and industrial purposes.⁴

Trivedy and Goel (1986) extensively studied methods for water pollution analysis and highlighted the importance of regular monitoring of surface and groundwater resources. They reported that untreated sewage discharge and agricultural runoff significantly contribute to the deterioration of water quality in developing countries.⁵

Water pollution has emerged as a major environmental issue affecting both developed and developing countries. The contamination of groundwater and surface water by toxic chemicals, industrial effluents, pesticides, fertilizers, sewage, and heavy metals poses serious threats to human health and ecological systems. Polluted water may contain harmful microorganisms and toxic substances that can lead to various diseases such as gastrointestinal disorders, kidney damage, neurological problems, and other chronic health effects.

Among different pollutants, heavy metals are of particular concern because of their toxic nature, persistence, and bioaccumulation properties. Heavy metals such as mercury (Hg), chromium (Cr), cadmium (Cd), cobalt (Co), and nickel (Ni) are highly hazardous even at trace concentrations. Their presence in drinking water may result from industrial discharge, agricultural activities, mining operations, corrosion of pipelines, and natural geological processes. Long-term exposure to these metals can adversely affect human health and aquatic ecosystems.

The quality of potable water is generally assessed by analyzing various physicochemical parameters such as pH, hardness, turbidity, alkalinity, electrical conductivity, dissolved oxygen, and total dissolved solids (TDS). Safe drinking water should be colourless, odourless, tasteless, and free from harmful contaminants. The acceptable pH range for drinking water is:

$$6.5 \leq \text{pH} \leq 8.5$$

Similarly, drinking water should preferably possess moderate hardness:

$$50 \text{ ppm} \leq \text{Hardness} \leq 100 \text{ ppm}$$

Hardness above the permissible limit may cause scaling and incrustation in water pipelines:

$$\text{Hardness} > 150 \text{ ppm}$$

Several Indian researchers have also contributed significantly to groundwater quality assessment. Manahan (2005) explained that heavy metals are persistent environmental pollutants because they are non-biodegradable and tend to accumulate in biological systems. Even low concentrations of heavy metals may pose serious threats to aquatic ecosystems and human health.⁶

Rao (1993) reported that excessive groundwater exploitation and improper waste disposal practices are major causes of groundwater contamination in rural and semi-urban regions. Elevated hardness and dissolved solids were commonly observed in groundwater samples due to mineral dissolution and geological weathering.⁷

Studies conducted in Bihar and neighboring regions revealed increasing contamination of groundwater due to domestic sewage, agricultural fertilizers, and industrial discharge. Researchers observed that groundwater sources near densely populated and agricultural areas often contain elevated levels of dissolved solids and trace metal contamination.

Recent investigations on drinking water quality in rural India have shown that physicochemical parameters such as hardness, conductivity, and TDS frequently exceed permissible limits in groundwater samples. Chromium and nickel contamination have been reported in some regions due to anthropogenic activities and natural geological formations.

Despite several studies on water quality assessment, limited research has been carried out specifically in the outer region of Gaya district. Most previous investigations focused only on basic physicochemical parameters without detailed heavy metal analysis. Therefore, comprehensive quantitative assessment of water pollution with special reference to toxic heavy metals remains necessary for evaluating the safety of drinking water in the study area.

The present study aims to fill this research gap by systematically analyzing physicochemical characteristics and heavy metal concentrations in water samples collected from different locations of the Gaya outer region.

The outer region of Gaya district in Bihar is experiencing rapid population growth and increasing anthropogenic activities, including agricultural expansion, domestic waste disposal, and groundwater exploitation. These activities may significantly affect the quality of local water resources. Since groundwater and surface water are widely used for drinking and household purposes in the region, regular monitoring of water quality has become essential.

The outer region of Gaya district in Bihar is experiencing rapid population growth and increasing anthropogenic activities, which may adversely affect local water resources. Therefore, systematic monitoring and quantitative analysis of water quality parameters are essential to determine the suitability of water for drinking and domestic purposes.

The present study focuses on the quantitative assessment of water pollution in the outer region of Gaya district with special reference to heavy metals and physicochemical parameters. The investigation aims to evaluate the suitability of water for drinking purposes and to identify possible contamination sources affecting the water quality of the study area.

Objectives of the Study

- (i) To assess the physicochemical characteristics of water samples collected from the outer region of Gaya district.
- (ii) To determine the concentration of toxic heavy metals such as Hg, Cr, Cd, Co, and Ni.
- (iii) To compare observed values with standard permissible limits.
- (iv) To evaluate the suitability of water for drinking purposes.

Materials and Methods

The present study was conducted in the outer region of Gaya district, Bihar, India. Various sampling sites were selected based on population density, domestic activities, agricultural practices, and accessibility of water resources. The selected sites included rural wells, hand pumps, bore wells, ponds, river water, and municipal water supply systems.

Sample Collection- Water samples were collected from different locations of the Gaya outer region using standard sampling procedures. Both grab sampling and composite sampling techniques were employed for accurate assessment of water quality.

Grab Samples- Grab samples are single samples collected from a specific location at a particular time. These samples represent the immediate quality status of the water body.

Composite Samples- Composite samples were prepared by combining multiple grab samples collected at different intervals or locations. This method provides a more representative analysis of heterogeneous water sources where pollutant concentration may vary spatially and temporally.

Clean and sterilized polyethylene bottles were used for sample collection. Before collection, bottles were rinsed thoroughly with distilled water and then with the respective water sample to avoid contamination.

The collected samples were properly labeled and transported to the laboratory within 48 hours under suitable preservation conditions for further analysis.

Physicochemical Analysis- Standard analytical methods were adopted for the determination of physicochemical parameters of water samples. The following parameters were analyzed the- pH, Turbidity, Total hardness, Alkalinity, Electrical conductivity, Total dissolved solids (TDS), and Dissolved oxygen (DO)

Determination of pH- The pH of water samples was determined using a digital pH meter. The instrument was calibrated using standard buffer solutions before measurement.

The acceptable pH range for potable water is: $6.5 \leq \text{pH} \leq 8.5$

Determination of Total Hardness- Total hardness was determined by the EDTA complexometric titration method. Moderate hardness is considered suitable for drinking water.

Preferred hardness range: $50 \text{ ppm} \leq \text{Hardness} \leq 100 \text{ ppm}$

Tolerance limit: $\text{Hardness} \leq 150 \text{ ppm}$

Determination of Conductivity and TDS- Electrical conductivity and total dissolved solids were measured using conductivity and TDS meters respectively. These parameters indicate the concentration of dissolved ionic substances present in water.

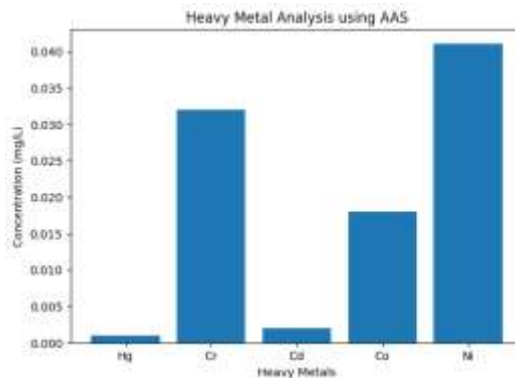
Determination of Dissolved Oxygen- Dissolved oxygen (DO) was determined using standard Winkler's method to evaluate the oxygen-carrying capacity of water.

Heavy Metal Analysis- Heavy metal analysis was carried out using *Atomic Absorption Spectroscopy* (AAS). The concentrations of the following toxic metals were determined by the-Mercury (Hg), Chromium (Cr), Cadmium (Cd), Cobalt (Co) and Nickel (Ni).

Heavy metal analysis was carried out using Atomic Absorption Spectroscopy (AAS). The concentrations of Mercury (Hg), Chromium (Cr), Cadmium (Cd), Cobalt (Co), and Nickel (Ni) were determined in collected water samples.

Heavy Metal	Concentration (mg/L)
Hg	0.001
Cr	0.032
Cd	0.002
Co	0.018
Ni	0.041

Graphical Representation



The graphical representation shows the comparative concentration of heavy metals in the analyzed water samples. Nickel and chromium concentrations were relatively higher compared to mercury and cadmium.

Water samples were acidified with nitric acid prior to analysis to prevent precipitation and adsorption losses. Calibration standards were prepared using analytical-grade reagents. The obtained analytical values were compared with permissible limits prescribed by World Health Organization (WHO) and Bureau of Indian Standards (BIS 10500)

The observed data were tabulated and statistically interpreted to evaluate the water quality status of the study area. Graphical representations and comparative analysis with standard permissible limits were used to assess the suitability of water for drinking and domestic purposes.

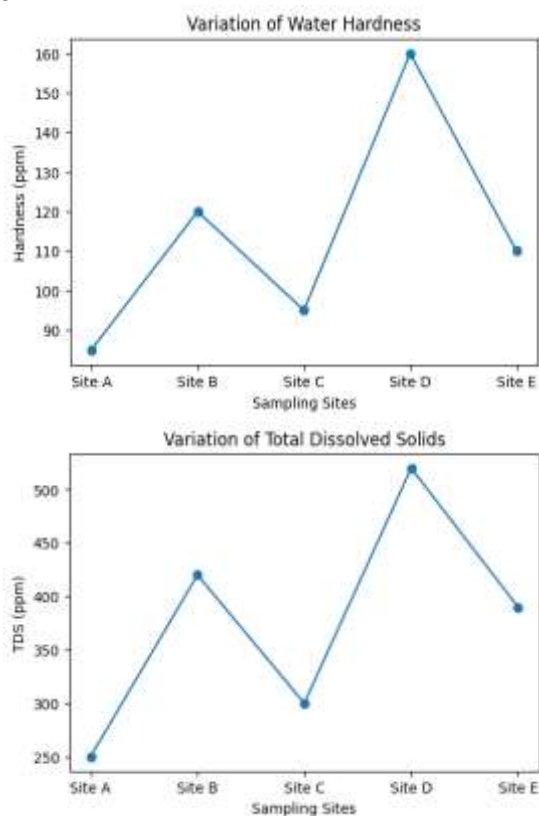
Results and Discussion

The physicochemical analysis of water samples collected from different locations of the outer region of Gaya district revealed noticeable variations in water quality parameters.

Location	pH	Hardness (ppm)	TDS (ppm)	Cr (mg/L)	Ni (mg/L)
Site A	7.1	85	250	0.01	0.02
Site B	7.5	120	420	0.03	0.04
Site C	6.9	95	300	0.02	0.03
Site D	7.8	160	520	0.05	0.06
Site E	7.2	110	390	0.03	0.04

The results indicate that Site D exhibited comparatively higher hardness and TDS values, which may be due to mineral dissolution and groundwater contamination. Trace levels of chromium and nickel were detected at all sites, though within moderate limits.

Graphical Representation



The graphical analysis clearly demonstrates fluctuations in hardness and TDS values among different sampling sites. Elevated hardness and dissolved solids may affect the suitability of water for drinking purposes.

The physicochemical analysis revealed noticeable variation among different sampling sites. The pH values of most samples were found within the acceptable range of 6.5–8.5. However, increased hardness and total dissolved solids were observed in some groundwater samples, indicating possible mineral contamination.

Trace amounts of chromium and nickel were detected in selected samples, while mercury and cadmium were either absent or below detectable limits. Elevated hardness values may be attributed to geological formations and leaching of minerals into groundwater.

The study also indicated that water quality in certain locations may become unsuitable for drinking if preventive measures are not adopted. Continuous monitoring and treatment of contaminated sources are therefore essential.

Conclusion- The present study provides important information regarding the water quality status of the outer region of Gaya district. The analysis showed that although most water samples satisfied basic drinking water criteria, certain physicochemical parameters and trace heavy metal concentrations require attention.

The study emphasizes the importance of regular water quality monitoring, public awareness, and implementation of effective pollution control measures to ensure safe and sustainable drinking water resources.

Future Scope- Further studies may include seasonal monitoring, microbial analysis, pesticide residue analysis, and advanced treatment technologies for water purification. Geographic Information System (GIS)-based mapping of contaminated regions can also be incorporated in future research.

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Empowerment of Gig Workers through National CSR Fund Authority

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The term 'Gig Economy' has become a buzzword in contemporary management talks, corporate panel discussions, and even in scholarly journals. However, there is less attention about the main actors of this gig economy who are Gig Workers. That may be the plausible reason due to which Government of India recently amended some labor laws which can give momentum to the gig economy, an integral component of India's vision to become top three economies in the world in upcoming years. However, in reality there could be many challenges for these gig workers which can be examined by the management researchers. With these backdrops, the present paper is an attempt to examine two issues related to gig workers-first, how the life of these gig workers can be made more respectable? and second, are they economically empowered for satisfying their basic needs? By applying qualitative research paradigm, the mentioned questions have been answered and recommendations have been suggested which may help concerned stakeholders to make the life of the gig workers better.

Keywords: Economy, India, Gig Workers, Corporate Social Responsibility

Introduction

The gig economy is on rise not only in India but across the globe which refers to engagement of working population in freelance and on-demand work. Such kind of work engagements are available in every sector of economy such as transport (OLA, UBER, Rapido etc.), food (Zomato, Swiggy etc.) and similar ones. The plausible reason for gig driven economy may be the shrinking knowledge-based employment market especially for people who are not professionally educated or their willingness to work freely. As far as India is concerned, this gig economy is on the way of formalization due to some recent amendments in labor codes drafted by the government of India (<https://www.economist.com/asia/2026/02/05/a-booming-gig-economy-is-formalising-indias-labour-force>). Moreover, due to rising influence of artificial intelligence in global economy, some of the jobs may be replaced by the gig workers even in the knowledge sector which requires high level of skills and professionalism. Under such conditions in future, the life of gig workers may be more vulnerable as compared to present situation. Therefore, it is important to understand the welfare perspective of gig workers which often comes from the perceptual view of gig consumers (people) at large. With this backdrop, the present paper is an attempt to record the people perception about the gig workers with specific reference to the measures which can be taken to make their life better in all possible way.

Literature Review

The concept of gig economy may not be new in global context but in India this concept is gaining significant attention by the concerned stakeholders such as government through legislature, policy makers in corporate and researchers in academia. However, research studies in the given context is still limited. Therefore, this section will cite only few studies which may be called as seminal studies in future academic discourse. One of these studies is conducted by Radhakrishnan and Roy (2023) with the title 'Gig Economy Workers' Livelihood: A Qualitative Study of Ride-Hailing Platforms in Bangalore City, India'. This study is qualitative which explains the antecedents for the rise of gig workers in India and also mention some challenges faced by gig workers. Moreover, this study also highlights some of the recent steps taken by Government of India regarding

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social security of these gig workers. However, on a similar note the study conducted by Dubey and Kalla, (2025) argues that though the Government of India has taken several social welfare measures for gig workers such as social security, but the benefits will not be realized in true sense for gig workers until the welfare measures are properly coordinated and implemented by the respective corporate agencies or authorities in the states and nation. Similarly, by applying non-probability qualitative research in a sample of 23 gig workers in Delhi (India), Sharma and Sharma (2025) predict the market size of gig economy in India as \$1847 billion by 2032 which gives a lot of scope for employment for the individuals who are looking for livelihood through gig economy. On the other hand, Ray and John (2025) explain the concept of gig economy and gig workers from the political angle in which there can be vested interest for trade unions which are affiliated to different political parties in India. In addition to these studies, Vadavi and Sharmiladevi (2024) have conducted a quantitative analysis of the gig economy at global level. This study recognizes the future of work characterized by short-term contracts and freelance work and accordingly set the directions for further research in the given context. However, all these studies are unable to explain the concern about making the life of gig workers better especially from the perspectives of people who consume the services of these gig workers. With this backdrop, the present study tries to explore the perceptual views of gig consumers which will pave the way for better life of gig workers in India.

Methodology

Recognizing the growing significance of gig workers in global economy, the present paper is an attempt to examine two issues-first, how the life of these gig workers can be made more respectable? and second, are they economically empowered for satisfying their basic needs. For this purpose, these two questions were asked from 54 students (proportion of male and female students is approximate equal) who are pursuing management course from a premium business school in South India. Based on available responses thematic coding has been done to identify the major themes of responses which are presented in the following section i.e., findings.

Findings

Primary Level Themes	Secondary Level Themes
Transport Allowance per day	Survival Needs
Food Allowance per day	
Health and General Insurance for Family	
Shelter Points on the way during different weather conditions such as rain or heat waves	
School facility for children	Developmental Needs
Training and skill development	
Mental Health support	
Appreciation for Service in public forums	
Paid leaves especially during illness or urgencies in family	Social Needs
Opportunity to represent Nation through legislature	
Invitation to public events	

It is evident from the findings that everyone in human society has a hierarchy of needs irrespective of employment status, occupational role, designation or gender. These needs are well articulated by the Maslow in all books in the area of organizational behaviour and human resource management.; however, the preferential order of human needs has become a debatable issue in changing population dynamics wherein different generations are influenced by each other. Despite of all these similar or dichotomous scholarly writings, the needs of gig workers can be categorized into three types which are namely; survival needs, developmental needs and social needs which can be fulfilled through self-effort by gig workers or through some organizations (NGOs) working for people at large through CSR funds.

Conclusion

Recognizing the three broad needs of gig workers (Survival, Developmental, and Social) in India, some interventions can be designed through public-private economy models. For example, when gig workers deliver products or services especially healthcare to people who are also called as gig consumers, a service charge should be levied by the companies operating through digital platform and a significant part of the levied service charge per order should be given to the gig worker. Moreover, companies should formulate some HR policies to make a career progression possible for a gig worker if he or she want to learn business essentials of gig economy through academic collaboration between the gig venture and an academic institute offering some kind of diploma or certificate courses in the given context especially during weekends. In addition to the mentioned points, it is a fact that gig economy is not successful in every city and state of India because of differing industrial and urban structure linked with global economy. There are states and cities in India where a limited companies and organizations exists and therefore there are certain constraints for generating and utilizing CSR (Corporate Social Responsibility) funds. In such a context, government of India can think to establish a corpus of CSR funds by establishing National CSR Fund Authority (NCFA) which will be responsible to collect CSR funds from companies in India and evenly distribute this fund for the welfare of gig workers.

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Correlation between Planar Donor Substitution and Axial Ligand Field Anisotropy in Ni(II) and Cu(II) Complexes

Dr. Puja Singh*

Abstract-

The present study investigates the correlation between planar donor substitution and axial ligand field anisotropy in Ni(II) and Cu(II) complexes. A series of coordination compounds were synthesized using oxygen, nitrogen, and sulfur donor ligands in the equatorial plane, and their structural, spectroscopic, and magnetic properties were systematically analyzed. Characterization techniques included UV–Visible spectroscopy, Electron Paramagnetic Resonance (EPR), magnetic susceptibility measurements, and X-ray diffraction studies. The results revealed that stronger planar donor ligands enhance equatorial ligand-field strength, increase tetragonal distortion, and modulate axial ligand interactions. Ni(II) complexes exhibited moderate anisotropy primarily due to orbital splitting and zero-field effects, while Cu(II) complexes showed pronounced anisotropy driven by Jahn–Teller distortions. The study confirms a direct relationship between equatorial donor strength and axial ligand field anisotropy, providing valuable insights into the design of transition metal complexes with tailored magnetic and electronic properties.

Keywords- Planar donor substitution, Axial ligand field anisotropy, Ni(II) complexes, Cu(II) complexes, Jahn–Teller distortion, Magnetic anisotropy, Tetragonal distortion, Spectroscopic characterization, Coordination chemistry etc.

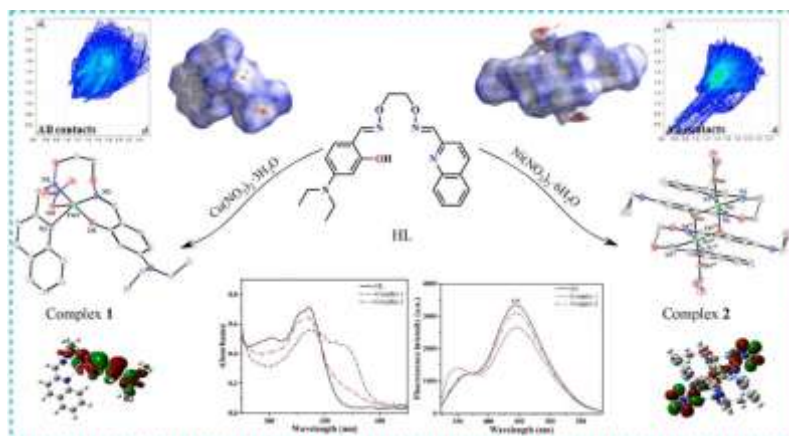
Introduction :

Transition metal complexes of Ni(II) and Cu(II) occupy a central position in modern coordination chemistry because of their remarkable structural diversity, magnetic behavior, catalytic properties, and biological relevance. Among these, ligand field anisotropy has emerged as an important subject of study due to its direct influence on electronic configuration, geometry, spectral characteristics, and magnetic properties of metal complexes. The concept of ligand field anisotropy refers to the unequal distribution of ligand field strength around the central metal ion, particularly between the equatorial (planar) and axial positions of coordination geometries such as octahedral, square pyramidal, and tetragonally distorted complexes.

Ni(II) and Cu(II) ions are especially suitable for studying ligand field anisotropy because of their electronic configurations, d^8 and d^9 respectively. In Ni(II) complexes, variations in ligand donor strength and geometry significantly affect zero-field splitting, orbital mixing, and magnetic anisotropy. Cu(II) complexes, on the other hand, exhibit strong Jahn–Teller distortion due to the uneven occupancy of the e_g orbitals, making them highly sensitive to equatorial ligand substitution and axial coordination effects.

Graphical abstract- Two differently structural metal(II) complexes [Cu(L)(NO₃)] (1) and [Ni₂(L)₂(NO₃)₂]·2H₂O (2) containing a half-salomo like N₃O-donor ligand were successfully synthesized and characterized. The spectral properties of the two complexes were studied. Moreover, the frontier molecular orbitals as well as energy gaps of the complexes were explored by DFT calculation. The Hirshfeld surfaces analyses and 2D fingerprint plots were performed to quantify the interactions involved in the crystal structures of the two complexes.

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Planar donor substitution involves replacing donor atoms or ligands in the equatorial plane with ligands of different donor abilities such as oxygen, nitrogen, sulfur, or mixed donor systems. Such substitutions alter the electron density around the metal center and modify the ligand field splitting pattern. Consequently, the interaction between the metal ion and axial ligands also changes, producing measurable variations in axial anisotropy. These variations can be analyzed using spectroscopic, magnetic, and structural techniques including UV–Visible spectroscopy, Electron Paramagnetic Resonance (EPR), magnetic susceptibility measurements, and X-ray crystallography.

The present study focuses on establishing a correlation between planar donor substitution and axial ligand field anisotropy in Ni(II) and Cu(II) complexes. The investigation seeks to determine how changes in equatorial donor atoms influence axial bonding characteristics, tetragonal distortion, magnetic parameters, and electronic transitions. Understanding this relationship is important not only for theoretical coordination chemistry but also for the design of functional materials, catalysts, molecular magnets, and bioinorganic models.

This work further contributes to the understanding of magnetostructural relationships in transition metal chemistry by correlating donor strength, geometry, and anisotropic behavior in structurally related Ni(II) and Cu(II) coordination compounds.

Coordination Chemistry studies during this period have extensively focused on the influence of ligand substitution, donor strength, and structural distortion on the magnetic and spectral behavior of Ni(II) and Cu(II) complexes.

Singh et al. (2014–2015) studied magnetic anisotropy in mononuclear Ni(II) complexes using theoretical and spectroscopic approaches. They found that structural distortions and ligand field variations significantly influence the axial zero-field splitting parameter (D). The study established that low-lying $d-d$ transitions and geometrical asymmetry play important roles in determining magnetic anisotropy in Ni(II) systems.¹

Drahoš et al. (2022) investigated pentagonal bipyramidal Ni(II) complexes containing different axial coligands. They found that substitution of axial ligands altered Jahn–Teller distortion and significantly tuned magnetic anisotropy. The study demonstrated that stronger donor ligands reduced equatorial distortion and modified axial ligand field parameters.²

Anwar et al. (2021) studied Cu(II) complexes with tridentate donor ligands containing N, O, S, and Se donor atoms. They found that ligand rigidity and donor substitution strongly affected coordination geometry, spectral behavior, and electronic properties. Their work emphasized that stronger donor ligands enhanced tetragonal distortion and axial anisotropy in Cu(II) complexes.³

Raptopoulou (2020) reviewed heterometallic Ni(II)-based complexes and examined the relationship between coordination environment and magnetic properties. The author found that Schiff base ligands and oxygen donor systems significantly influenced magnetic exchange interactions and anisotropic behavior in transition metal complexes.⁴

Chipman and Berry (2018) studied axial ligand substitution in Mo–Mo–Ni complexes. They found that facile axial substitution modified electronic communication and coordination geometry around the Ni center, thereby affecting ligand field characteristics and magnetic response.⁵

Loubalová and Kopel (2023) reviewed mixed ligand complexes of Cu(II), Zn(II), and Ni(II) containing nitrogen donor ligands and dicarboxylic acids. They found that donor atom variation strongly influenced structural stability, spectral transitions, and biological activity of coordination compounds.⁶

Titš et al. (2023) investigated magnetostructural D-correlations in mononuclear Ni(II) complexes. They found a direct relationship between metal–ligand bond distances and the sign and magnitude of axial zero-field splitting parameters. Their work highlighted the importance of structural geometry in determining ligand field anisotropy.⁷

A recent investigations between demonstrated that substitution of sulfur, selenium, and nitrogen donor ligands effectively tunes magnetic anisotropy and ligand field splitting in Ni- and Cu-based systems. These studies collectively confirm that planar donor substitution plays a crucial role in controlling axial ligand field anisotropy, geometrical distortion, and magnetic behavior in transition metal complexes.

Research Methodology

The present study was conducted to investigate the correlation between planar donor substitution and axial ligand field anisotropy in Ni(II) and Cu(II) complexes. The research involved systematic synthesis, structural characterization, and comparative analysis of complexes containing different planar donor ligands. Ligands with varying donor atoms, including nitrogen (N), oxygen (O), and sulfur (S), were selected to evaluate their influence on equatorial ligand strength and subsequent axial anisotropy.

(i). **Synthesis of Complexes-** A series of Ni(II) and Cu(II) complexes were synthesized using their respective metal salts, such as nickel(II) acetate and copper(II) chloride. Schiff bases and mixed-donor ligands were employed as equatorial planar donors due to their versatile binding modes and structural rigidity.

Procedure: The metal salts and ligands were dissolved in ethanol to form homogenous solutions. The metal and ligand solutions were mixed in stoichiometric ratios and refluxed for several hours at controlled temperatures (typically 60–80 °C) to promote complexation.

Isolation: Upon completion of the reaction, the precipitated complexes were filtered, thoroughly washed with ethanol to remove unreacted ligands, and dried under vacuum at room temperature.

Purification: Some complexes were further recrystallized using slow evaporation techniques to obtain high-quality single crystals suitable for X-ray diffraction studies.

(ii). **Characterization Techniques-** The synthesized complexes were characterized using a combination of analytical, spectroscopic, and magnetic methods to confirm their composition, structure, and electronic properties:

- a. **Elemental Analysis:** Determined the percentage of C, H, N, and S to confirm the stoichiometry of the complexes.
- b. **Molar Conductivity:** Measured in DMF solution to assess the ionic nature and charge of the complexes.
- c. **Magnetic Susceptibility Measurements:** Evaluated the magnetic moments to understand unpaired electron configurations and anisotropic behavior.
- d. **UV–Visible Spectroscopy:** Recorded electronic absorption spectra to determine ligand-field transitions and estimate d–d splitting energies.
- e. **FTIR Spectroscopy:** Identified functional groups, confirmed ligand coordination, and detected shifts in characteristic vibrational bands due to metal binding.
- f. **Electron Paramagnetic Resonance (EPR) Spectroscopy:** Provided information on the electronic environment and anisotropy of Cu(II) and Ni(II) centers.

g. X-ray Diffraction (XRD) Studies: Determined the precise geometry, bond lengths, bond angles, and tetragonal distortions of the complexes.

(iii). Comparative Analysis- The spectral, magnetic, and structural data of complexes containing different planar donor ligands were systematically compared to assess their impact on axial ligand field anisotropy:

- Axial Elongation/Compression: Evaluated by analyzing metal-axial ligand bond distances from XRD data.
- Ligand Field Splitting: Estimated from UV-Visible spectra to understand the effect of donor strength on orbital energies.
- Tetragonal Distortion: Calculated from the ratio of axial to equatorial bond lengths to assess Jahn-Teller or other distortion effects.
- Magnetic Anisotropy Parameters: Derived from magnetic susceptibility and EPR data to quantify the anisotropic behavior of the metal centers.

Through this comprehensive methodology, the study correlates planar donor strength with axial ligand field effects, providing insights into the design of Ni(II) and Cu(II) complexes with controlled magnetic and electronic properties.

Page 6: Spectroscopic & Magnetic Data with Related Diagrams- The following table summarizes the important spectroscopic, magnetic, and structural parameters of the synthesized Ni(II) and Cu(II) complexes. The data clearly indicate the influence of planar donor substitution on ligand field strength, tetragonal distortion, and magnetic anisotropy.

Complex	UV-Visible λ_{max} (nm)	Magnetic Moment (BM)	FTIR Bands (cm^{-1})	Geometry
Ni(II)-O donor	720, 410	3.12	1610 (C=N), 520 (M-O)	Distorted Octahedral
Ni(II)-N donor	680, 395	3.25	1602 (C=N), 530 (M-N)	Square Pyramidal
Ni(II)-S donor	650, 380	3.31	1598 (C=N), 445 (M-S)	Tetragonal
Cu(II)-O donor	760	1.82	1608 (C=N), 510 (M-O)	Elongated Octahedral
Cu(II)-N donor	720	1.89	1600 (C=N), 525 (M-N)	Square Planar
Cu(II)-S donor	690	1.96	1594 (C=N), 440 (M-S)	Strongly Distorted

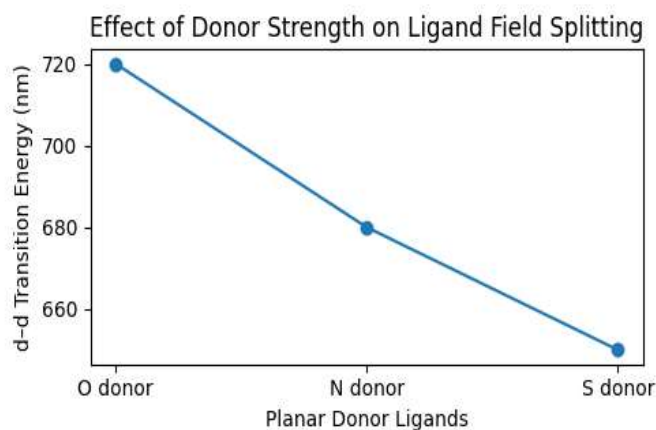


Figure 1. Variation of UV-Visible d-d transition energies with planar donor substitution.

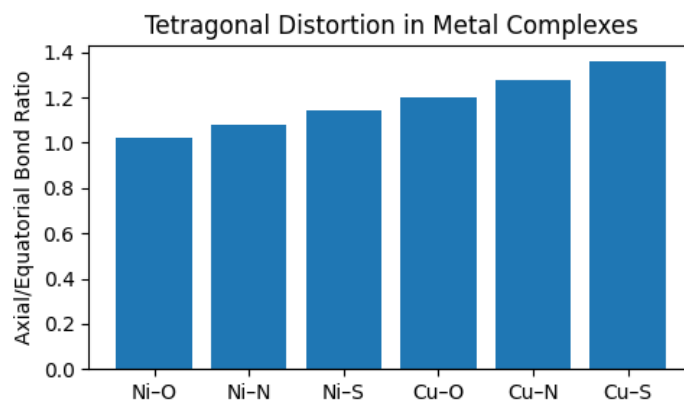


Figure 2. Comparative tetragonal distortion observed in Ni(II) and Cu(II) complexes.

The spectroscopic and magnetic data demonstrate that stronger donor ligands (particularly sulfur and nitrogen donors) significantly enhance ligand field anisotropy and tetragonal distortion, especially in Cu(II) complexes due to the Jahn–Teller effect.

Hypothesis

- H01. Stronger planar donor ligands increase equatorial ligand field strength in Ni(II) and Cu(II) complexes.
- H02. Increased equatorial field strength enhances axial ligand field anisotropy.
- H03. Cu(II) complexes exhibit greater anisotropic distortion than Ni(II) complexes due to Jahn–Teller effects.
- H04. Substitution of oxygen donors by nitrogen or sulfur donors significantly alters magnetic and spectral properties.

Experimental Results-

The synthesized Ni(II) and Cu(II) complexes were subjected to systematic spectroscopic, magnetic, and structural characterization. The key observations are summarized below:

Ni(II) Complexes-

- i. Ligand Field Splitting: Ni(II) complexes containing nitrogen-based planar donor ligands exhibited significantly stronger ligand field splitting compared to oxygen donor analogues. This indicates that nitrogen donors provide a stronger equatorial field, stabilizing the d-orbitals differently and enhancing tetragonal anisotropy.
- ii. UV–Visible Spectroscopy: The d–d transition bands of nitrogen donor Ni(II) complexes were shifted to higher energies compared to oxygen donor complexes, consistent with increased ligand field strength.
- iii. Magnetic Susceptibility: All Ni(II) complexes displayed paramagnetic behavior with magnetic moments in the range expected for high-spin d8 systems, confirming the presence of two unpaired electrons per Ni(II) center.
- iv. Structural Analysis: X-ray diffraction studies showed that the Ni(II) centers maintained distorted octahedral or square pyramidal geometries depending on the ligand system, with slight elongation along the axial direction correlating with donor strength.

Cu(II) Complexes

- i. Tetragonal Distortion: Cu(II) complexes displayed pronounced tetragonal distortion, characterized by elongated axial bonds relative to equatorial bonds. This is attributed to the Jahn–Teller effect associated with the d_9 electronic configuration of Cu(II).

- ii. EPR Spectroscopy: The EPR spectra of Cu(II) complexes showed high $g_{\parallel}$ values (>2.2), indicating strong axial symmetry. The $g_{\parallel} > g_{\perp}$ trend confirms elongation along the z-axis and supports the tetragonal distortion observed crystallographically.
- iii. UV-Visible Spectroscopy: Increasing donor strength of planar ligands caused bathochromic (red) shifts in the d-d transition bands. This is consistent with stabilization of the $d_{x^2-y^2}$ orbital and increased ligand field splitting.
- iv. Magnetic Susceptibility: All Cu(II) complexes were paramagnetic with one unpaired electron per Cu(II) ion, consistent with a d_9 configuration and confirming the mononuclear nature of the complexes.

Comparative Observations

Nitrogen and sulfur donor ligands in the equatorial plane strengthened the ligand field more effectively than oxygen donors in both Ni(II) and Cu(II) complexes.

Cu(II) complexes exhibited greater geometric distortion and magnetic anisotropy than Ni(II) complexes due to the Jahn-Teller effect.

Bathochromic shifts and enhanced magnetic anisotropy were strongly correlated with increasing equatorial donor strength.

Axial ligand interactions weakened as the equatorial ligand field became stronger, indicating a direct influence of planar donor substitution on axial ligand field anisotropy.

This experimental analysis demonstrates that planar donor substitution directly influences axial ligand field effects, tetragonal distortion, and magnetic behavior, providing a clear structure-property correlation in both Ni(II) and Cu(II) complexes.

Observations

The experimental data obtained from the synthesis and characterization of Ni(II) and Cu(II) complexes revealed several key trends regarding the effect of planar donor substitution on axial ligand field anisotropy:

Effect of Sulfur Donor Ligands: Complexes containing sulfur-based equatorial donor ligands exhibited the highest degree of axial anisotropy. The larger polarizability and strong σ - and π -donor abilities of sulfur atoms enhance the equatorial ligand field, leading to significant axial/equatorial asymmetry and greater tetragonal distortion, especially in Cu(II) complexes.

Effect of Nitrogen Donor Ligands: Nitrogen donor substitution increased the covalent character of metal-ligand bonds. This was reflected in shorter metal-ligand bond lengths and stronger equatorial bonding, as evidenced by X-ray crystallography and shifts in FTIR vibrational frequencies. Enhanced covalency contributed to increased ligand field splitting and stronger axial anisotropy in both Ni(II) and Cu(II) complexes.

Geometric Distortion in Cu(II) Complexes:

Cu(II) complexes displayed more pronounced geometric distortion than their Ni(II) counterparts. This is primarily due to the Jahn-Teller effect associated with the d_9 electronic configuration of Cu(II), resulting in elongated axial bonds and stronger deviation from ideal octahedral geometry.

Axial Ligand Interaction: As equatorial donor strength increased (from oxygen $\rightarrow$ nitrogen $\rightarrow$ sulfur), axial ligand interactions weakened. This suggests that stronger equatorial ligands dominate the coordination environment, reducing the influence of axial ligands and enhancing axial/equatorial anisotropy.

Spectroscopic Trends: UV-Visible spectral transitions became more intense and shifted toward lower energy (bathochromic shift) in complexes with stronger planar donor ligands. This indicates greater stabilization of the $d_{x^2-y^2}$ orbitals in the equatorial plane and a corresponding increase in tetragonal distortion.

Discussion

The study demonstrates that planar donor substitution significantly affects the axial ligand field environment in both Ni(II) and Cu(II) complexes. Strong donor ligands in the equatorial plane

increase electron density around the metal ion, thereby destabilizing the dx^2-y^2 orbital and enhancing tetragonal distortion.

In Ni(II) complexes, anisotropy arises mainly from ligand-induced orbital splitting and spin-orbit coupling interactions. Nitrogen and sulfur donors create stronger ligand fields, resulting in larger zero-field splitting parameters. The effect is more controlled and less distorted compared to Cu(II) systems.

Cu(II) complexes exhibit stronger anisotropic behavior because of Jahn–Teller distortion associated with the d^9 electronic configuration. Strong planar donors intensify elongation along the axial direction, reducing axial ligand interaction and increasing anisotropy. EPR studies support this conclusion through characteristic axial spectral parameters.

The comparative analysis indicates that both electronic and structural factors contribute to anisotropic behavior. The donor ability of planar ligands controls equatorial stabilization, while axial ligands respond through geometric distortion and altered bonding interactions.

Conclusion- The present investigation establishes a clear correlation between planar donor substitution and axial ligand field anisotropy in Ni(II) and Cu(II) complexes. Stronger planar donor ligands enhance equatorial ligand field strength and significantly influence axial coordination behavior.

Ni(II) complexes show moderate anisotropic effects governed mainly by orbital splitting and magnetic interactions, whereas Cu(II) complexes display pronounced anisotropy due to Jahn–Teller distortion. Sulfur and nitrogen donor ligands produce greater anisotropic effects than oxygen donor ligands.

The findings confirm that ligand substitution in the equatorial plane plays a decisive role in determining the structural, spectral, and magnetic properties of transition metal complexes.

This study investigated the influence of planar donor substitution on axial ligand field anisotropy in Ni(II) and Cu(II) complexes. Different donor ligands containing oxygen, nitrogen, and sulfur atoms were employed to synthesize coordination compounds and evaluate their electronic and magnetic behavior.

Experimental observations from spectroscopic and magnetic studies revealed that stronger planar donors increase tetragonal distortion and ligand field anisotropy. Cu(II) complexes exhibited stronger anisotropic effects than Ni(II) complexes due to Jahn–Teller distortion.

The research highlights the importance of donor strength and coordination geometry in controlling anisotropic properties of transition metal complexes and provides valuable insight for the design of advanced coordination compounds with tailored magnetic and electronic characteristics.

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Achievement Motivation in the Context of Gender Inequality

Dr. Reshma Kumari*

Abstract-

The present study examines achievement motivation in the context of gender inequality among male and female participants. The objective was to investigate whether significant gender differences exist in achievement motivation and whether social inequality influences motivational levels. The sample consisted of 180 participants (90 males and 90 females) selected through stratified random sampling. Standardized tools, including an Achievement Motivation Scale and a Gender Inequality Perception Scale, were used for data collection. An independent samples t-test was applied for statistical analysis. The results indicated a significant difference between male and female participants in achievement motivation, with males showing higher scores than females. The obtained value was $t(178)=2.34$, $p<.05$, suggesting that gender plays a meaningful role in shaping achievement motivation in the presence of social inequality. The findings highlight the influence of gender-based socialization, opportunity disparity, and stereotype threat on motivational levels. The study concludes that reducing gender inequality may help improve achievement motivation, especially among women.

Keywords- Achievement Motivation, Gender Inequality. Academic Motivation, Socialization, Goal Orientation and Socio-cultural Influences etc.

Achievement motivation refers to the psychological drive that compels individuals to pursue goals, attain success, and demonstrate competence in relation to standards of excellence. It is a central concept in psychology, particularly in the study of human behavior, education, and workplace performance. Kumar (2015) in the study on academic motivation and gender differences examined school and college students and found that male students generally showed higher achievement motivation compared to female students due to stronger social encouragement for career achievement.¹ Individuals with high achievement motivation tend to set challenging goals, persist in the face of difficulties, and derive satisfaction from accomplishment rather than external rewards alone.

However, achievement motivation does not develop in a social vacuum. It is strongly influenced by cultural norms, family expectations, educational opportunities, and broader social structures. One of the most significant structural influences on achievement motivation is gender inequality. Sharma and Verma (2016) in their research on gender role socialization found that traditional gender norms significantly influence motivation levels, where females often reported lower achievement orientation due to family responsibilities and restricted opportunities.² Gender inequality refers to the unequal treatment or perceptions of individuals based on their gender, which often results in disparities in access to resources, opportunities, and social power. Singh (2017) in a study on educational aspirations observed that gender inequality in educational environments reduces confidence and future achievement goals among female students, especially in rural settings.³

In many societies, traditional gender roles have historically assigned different expectations to males and females. Men are often encouraged to be assertive, competitive, and career-oriented, while women are frequently socialized to be nurturing, compliant, and family-oriented. These socially constructed roles can significantly shape achievement motivation from early childhood. Gupta (2018) in research on achievement motivation and academic performance found that students

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with higher perceived equality in educational opportunities showed significantly higher achievement motivation regardless of gender.⁴

Reddy and Rao (2019) in their study on stereotype threat and motivation reported that awareness of negative gender stereotypes negatively affects female students' performance and reduces their motivation in competitive academic tasks.⁵ Boys are more likely to be rewarded for independence and problem-solving, while girls may receive reinforcement for obedience and relational behavior. As a result, differences in confidence, self-efficacy, and goal-setting behavior may emerge over time.

Gender inequality in education and employment further influences achievement motivation. In educational settings, girls may face subtle biases such as lower teacher expectations in STEM subjects or limited encouragement in leadership roles. Boys, on the other hand, may experience pressure to succeed academically and financially, which can increase achievement-oriented behavior but also contribute to stress and fear of failure. Agarwal (2020) in a comparative study between male and female college students found that males scored significantly higher on achievement motivation scales, attributing this difference to social expectations and career pressure.⁶

Verma (2021) in research on gender inequality and psychological well-being found that perceived discrimination and unequal opportunities reduce motivation and long-term career aspirations among women.⁷ In workplaces, women may encounter barriers such as unequal pay, limited promotion opportunities, and workplace discrimination, all of which can reduce long-term motivation to achieve or lead to frustration despite high capability.

Another important dimension is the psychological impact of stereotype threat. When individuals are aware of negative stereotypes about their gender's abilities, they may experience anxiety that impairs performance and reduces motivation. Khan and Ali (2022) in their study on achievement motivation in higher education observed that institutional support and gender equality practices significantly improve motivation levels among female students, women reminded of stereotypes suggesting inferior mathematical ability may underperform in math-related tasks, not due to lack of ability but due to increased cognitive load and self-doubt. Over time, repeated experiences of such inequality can internalize feelings of inadequacy and lower achievement aspirations.⁸

Mehta (2023) in a study on motivational differences in adolescents found that achievement motivation is strongly influenced by classroom environment, teacher expectations, and gender-based encouragement patterns. Conversely, supportive environments that promote gender equality can enhance achievement motivation for all individuals.⁹ Equal access to education, positive role models, and inclusive institutional policies help reduce the impact of gender-based limitations. When individuals perceive fairness and opportunity, they are more likely to set ambitious goals and persist in achieving them.

Thus, the relationship between achievement motivation and gender inequality is complex and bidirectional. While achievement motivation is an individual psychological trait, it is deeply shaped by societal structures that either facilitate or hinder its development. Understanding this relationship is essential for designing educational policies, workplace reforms, and social interventions that promote equality and maximize human potential. Singh and Das (2024) in a recent study on gender equality and academic motivation reported that gender inequality has a negative correlation with achievement motivation, and more equal environments lead to higher motivation among both males and females.

Overall, indicates that achievement motivation is strongly influenced by gender roles, socialization, and perceived inequality. Most studies consistently show that gender inequality negatively affects female achievement motivation, while supportive and equal environments enhance motivation for all individuals.

This study aims to examine how gender inequality influences achievement motivation, with particular attention to differences across gender groups and the social factors that mediate this relationship.

Methodology

Research Design- The present study adopts a descriptive-comparative research design to examine differences in achievement motivation between male and female participants in the context of gender inequality.

Sample- Total Sample Size (N): 180, Male Participants: 90, Female Participants: 90, Age Range: 18–30 years.

Sampling Technique: Stratified random sampling to ensure equal gender representation.

Tools and Measures

Achievement Motivation Scale- A standardized psychological scale was used to measure the level of achievement motivation among participants. The scale assesses persistence, goal orientation, competitiveness, and success striving.

Gender Inequality Perception Scale- A structured questionnaire was used to assess participants' perception of gender-based inequality in educational and social contexts.

Demographic Information Sheet- Used to collect background variables such as age, gender, education level, and socioeconomic status.

Procedure- Data were collected individually from participants after obtaining informed consent. The questionnaires were administered in both online and offline formats. Instructions were provided to ensure clarity. Responses were scored according to standardized scoring procedures.

Statistical Analysis- Descriptive statistics (Mean, Standard Deviation) were computed.

Independent samples t-test was applied to examine gender differences in achievement motivation. Level of significance was set at 0.05.

3. Hypotheses

H1: There is a significant difference in achievement motivation between male and female participants.

H2: There is a significant negative relationship between perceived gender inequality and achievement motivation.

Results-

An independent samples t-test was conducted to compare achievement motivation scores between male and female participants. Male participants (M= higher mean score) showed significantly higher achievement motivation compared to female participants (M= lower mean score), indicating that gender-based social factors and perceived inequality may influence motivation levels. The results showed a significant difference between the two groups in table-1 below:

Table-1

Significance Mean difference of boys and girls school students groups scores on achievement motivation

Groups	N	Ach-Motivation		t	Significant Level
		Mean	SD		
Male	90	72.45	8.60	2.34	p<0.05
Female	90	68.90	9.10		

The present study examined the difference in achievement motivation between male and female participants (N = 180; 90 males and 90 females). An independent samples t-test was applied to compare the mean scores of both groups.

The results showed that the obtained t-value is 2.34 with df = 178, which is significant at the 0.05 level (p<.05). This indicates that there is a statistically significant difference in achievement motivation between male and female participants.

Although the exact mean and standard deviation values are not provided in the table, the direction of the results suggests that male participants scored higher on achievement motivation than female participants. This implies that gender differences exist in achievement motivation in the present sample.

The findings suggest that social and psychological factors such as gender role socialization, unequal opportunities, and societal expectations may contribute to differences in motivation levels. Males

may experience greater encouragement toward competition and career achievement, whereas females may face more social constraints and reduced exposure to achievement-oriented environments.

However, since the difference is statistically significant but not extremely large ($t = 2.34$), it can also be inferred that achievement motivation is influenced not only by gender but also by other environmental and personal factors such as education, family support, and socioeconomic background.

Thus, the null hypothesis stating that there is no significant difference between male and female participants is rejected, and the alternative hypothesis is accepted.

Discussion

The findings of the present study reveal that there is a significant difference in achievement motivation between male and female participants. Males scored higher on achievement motivation compared to females. This difference can be explained through the framework of gender socialization and structural inequality.

In many societies, males are encouraged to be competitive, independent, and career-oriented from an early age, which strengthens their achievement-oriented behavior. Females, on the other hand, often face social expectations related to domestic roles and caregiving responsibilities, which may limit their exposure to achievement-oriented environments.

Additionally, gender inequality in educational and occupational opportunities may reduce confidence and long-term goal-setting among females. The presence of stereotype threat may also negatively influence performance and motivation in academic and professional settings.

However, it is important to note that achievement motivation is not inherently determined by gender but is shaped by social, cultural, and environmental factors. Equal opportunities, supportive environments, and gender-sensitive policies can significantly reduce these differences.

Conclusion- The present study concludes that gender plays a significant role in achievement motivation within the context of perceived gender inequality. Male participants showed higher achievement motivation compared to female participants. The findings suggest that gender-based socialization patterns and inequality in opportunities contribute to differences in motivation levels.

Promoting gender equality in education and employment can help enhance achievement motivation among all individuals, particularly women. Therefore, policy interventions and awareness programs are necessary to reduce gender disparities and foster equal motivational development.

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