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Editorial

Education stands at a pivotal moment in history. Rapid technological advancements, globalization, environmental challenges, and evolving societal expectations have transformed the way knowledge is created, shared, and applied. In this dynamic context, educational research assumes a critical role in guiding policy, informing practice, and shaping the future of learning. It is through rigorous inquiry and evidence-based scholarship that educators, researchers, and policymakers can respond effectively to contemporary challenges while envisioning innovative pathways for educational development.

This issue of the journal brings together diverse perspectives that reflect the complexity and richness of educational research today.

Another significant trend reflected in current scholarship is the integration of technology into teaching and learning. Digital tools have expanded opportunities for access, collaboration, and personalized learning. However, technology alone cannot guarantee educational improvement. Research continues to demonstrate that meaningful learning occurs when technological innovations are thoughtfully aligned with pedagogical objectives, learner needs, and equitable implementation.

As we present this issue, we extend our sincere appreciation to the authors who have shared their valuable work, the reviewers whose expertise ensures scholarly rigor, and the readers whose engagement sustains the academic community.

We hope that the articles featured in this issue inspire thoughtful reflection, stimulate scholarly discussion, and encourage future research endeavours. In an era characterized by rapid change and unprecedented challenges, educational research remains a powerful catalyst for innovation, inclusion, and sustainable progress.

Editors

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A Study of Knowledge, Perceptions and Practices about Menstruation and Self among Secondary School Girls

Mahrukh Kamran

Abstract

Menstruation remains stigmatised and misunderstood among adolescent girls, leading to physical, emotional, and psychological distress. This study investigated menstruation knowledge, practices, and perceptions among secondary school girls, (sample size - 462) exploring influences of self-knowledge, family, peers, and educational interventions. The study used a quantitative approach with girls aged 12-18.

Results revealed significant knowledge gaps, with the majority of the respondents demonstrating moderate understanding of menstrual physiology and organs associated with menstruation. Higher knowledge levels were seen in case of distinction between facts and myths. Perceptions were largely high, but did indicate scope for improvement in a significant number of girls. Notably, very few respondents practised good menstrual hygiene, as most of them were in the moderate and low category.

These findings highlight the need for comprehensive menstruation education and supportive environments to empower adolescent girls. Schools, families, and communities must prioritise menstrual health education, addressing stigma, myths, and misconceptions. Enhancing self-knowledge and promoting positive attitudes can improve menstrual health outcomes, overall well-being, and gender equality.

The study underscores the importance of holistic approaches to menstrual health education, encompassing physical, emotional, and social aspects. Implications for policy, practice, and research inform school-based interventions, community programs, and effective menstrual health strategies. Keywords: Menstruation Education, Adolescent girls, Knowledge, Practices, Perceptions

Introduction

Menstruation is a natural biological process that marks an important stage in the development of adolescent girls. Despite its significance, menstruation is often surrounded by myths, stigma, misconceptions, and inadequate knowledge. These factors influence girls' perceptions, emotional well-being, and menstrual hygiene practices. The study, conducted among secondary school girls, examined their knowledge about self and menstruation, perceptions regarding menstruation, and practices followed during menstruation. The research also explored the relationships among these variables and the influence of demographic factors.

The study emphasizes that adolescence is a critical developmental period characterized by physical, emotional, and cognitive changes. Proper preparation before menarche, support from parents and teachers, and access to accurate information are essential for helping girls manage menstruation confidently and healthily.

Conceptual Framework

The study was built around three interconnected dimensions:

1. Knowledge of Menstruation

Knowledge refers to awareness and factual understanding of menstruation, including reproductive physiology, menstrual hygiene management, menstrual products, and sources of information. Adequate knowledge helps reduce misconceptions and promotes healthy menstrual practices. Schools, families, peers, healthcare workers, and media all contribute to girls' understanding of menstruation.

2. Perceptions of Menstruation

Perceptions involve attitudes, beliefs, and feelings regarding menstruation. Cultural norms, taboos, family influences, and social interactions often shape these perceptions. Positive perceptions contribute to confidence and healthy menstrual management, whereas negative perceptions can result in shame, fear, and stigma.

3. Practices During Menstruation

Practices include the behaviours adopted by girls during menstruation, such as the use of sanitary products, frequency of changing absorbents, disposal methods, hygiene maintenance, and management of menstrual discomfort. Healthy practices are influenced by both knowledge and perceptions.

The study highlights that knowledge, perceptions, and practices are interrelated. Better knowledge tends to foster positive perceptions, which in turn encourage healthier menstrual practices.

Objectives and Methodology

The major objectives of the study were:

1. To assess knowledge of self among secondary school girls.
2. To determine their knowledge of menstruation.
3. To study their perceptions regarding menstruation.
4. To examine practices followed during menstruation.
5. To analyse relationships among knowledge, perceptions, practices, and demographic variables.

A quantitative research approach was adopted. Data were collected from 462 secondary school girls aged 12–18 years through a structured questionnaire. The study used descriptive and inferential statistical techniques to analyse the data and test hypotheses concerning knowledge, perceptions, and practices related to menstruation.

Major Findings

Knowledge about Menstruation

The findings revealed that most respondents possessed a moderate level of knowledge regarding menstruation. Girls were generally aware of basic facts and could distinguish myths from scientific facts. However, gaps remained in understanding menstrual physiology, reproductive organs, and menstrual health management.

The study found significant differences in levels of menstrual knowledge among respondents. Although awareness existed, comprehensive understanding was still lacking, indicating the need for systematic menstrual education programs. Schools and families remain important sources of information and support.

Perceptions about Menstruation

A majority of respondents demonstrated positive perceptions toward menstruation. Approximately 61% showed highly positive perceptions, while nearly one-third reported moderate perceptions. No respondents were found to have extremely negative perceptions. However, misconceptions and socio-cultural influences continued to affect attitudes toward menstruation.

The findings suggest that perceptions are strongly shaped by education, cultural beliefs, family environment, and social norms. Girls with better information tended to view menstruation as a natural biological process rather than a source of embarrassment or restriction.

Practices During Menstruation

The study found that menstrual hygiene practices were not always satisfactory. While many girls used sanitary napkins and followed appropriate disposal methods, only a small proportion demonstrated consistently good menstrual hygiene practices. Most respondents fell within moderate or low categories of practice.

Key observations included:

- Most girls preferred sanitary napkins over cloth.
- Nearly three-fourths disposed of sanitary products properly by wrapping and placing them in dustbins.
- About two-thirds tracked their menstrual cycles.
- Physical exercise during menstruation was reported by fewer than one-fourth of respondents.
- Dietary modifications during menstruation were reported by approximately one-fourth of the girls.
- Some restrictions, particularly avoidance of religious activities, continued to be practiced.

These findings indicate progress in menstrual hygiene management but also reveal opportunities for further improvement through education and awareness initiatives.

Relationships among Knowledge, Perceptions, and Practices

One of the most significant findings was the positive relationship among knowledge, perceptions, and practices.

Knowledge and Self-Knowledge

The study found a statistically significant positive relationship between knowledge of menstruation and knowledge of self. Girls who understood menstruation better also demonstrated greater awareness of their bodies and reproductive health.

Knowledge and Perceptions

A moderate positive correlation was found between menstrual knowledge and perceptions. Increased knowledge reduced misconceptions and stigma, resulting in more positive attitudes toward menstruation. Educational interventions were shown to improve perceptions significantly.

Self-Knowledge and Practices

A weak but significant positive relationship was observed between self-knowledge and menstrual practices. Girls with greater self-awareness were more likely to adopt healthy menstrual hygiene behaviours and effective self-care practices.

These findings reinforce the importance of menstrual education as a tool for improving both attitudes and behaviours.

Educational Implications and Recommendations

The study highlights the need for a comprehensive and collaborative approach to menstrual health education.

For Students

- Develop accurate knowledge about menstruation and reproductive health.
- Learn proper menstrual hygiene management.
- Follow healthy dietary and exercise habits.
- Build positive attitudes and confidence regarding menstruation.
- Participate in peer-support networks and awareness programs.

For Parents and Guardians

- Encourage open communication regarding menstruation.
- Provide accurate information and emotional support.
- Challenge myths and negative beliefs.
- Help daughters develop healthy hygiene habits and positive self-esteem.

For Teachers and Schools

- Integrate menstrual health education into the curriculum.

- Conduct awareness programs and workshops.
- Ensure access to clean toilets, water, and sanitary products.
- Create a supportive and stigma-free school environment.
- Encourage both girls and boys to understand menstrual health issues.

For Policymakers

- Strengthen menstrual health policies.
- Provide free or subsidized sanitary products.
- Improve school sanitation infrastructure.
- Support teacher training and community awareness campaigns.
- Promote research and monitoring of menstrual health initiatives.

Conclusion

The study concludes that although secondary school girls possess moderate levels of knowledge and generally positive perceptions about menstruation, substantial gaps remain in menstrual hygiene practices and comprehensive understanding of menstrual health. Many misconceptions and cultural restrictions continue to influence girls' experiences. The findings demonstrate that improved knowledge leads to more positive perceptions and healthier practices. Therefore, schools, families, communities, and policymakers must work together to provide accurate information, supportive environments, and accessible resources for adolescent girls. Such efforts can improve menstrual health, enhance self-confidence, reduce stigma, and contribute to the overall well-being and empowerment of young women.

A Correlational Study on the Impact of Mental Health on Academic Achievement of Higher Secondary Science & Mathematics Stream Learners

Fatima Tabassum

Abstract

The study aims to explore the Impact of Mental Health on the academic achievement of Higher Secondary Learners of Science and Mathematics streams, specifically focusing on MPC and BiPC students in the MehdiPatnam area of Hyderabad. The research draws from a sample of 480 students, equally divided across gender and stream, and employs the Mental Health Battery by Singh and Gupta to assess mental health.

Academic achievement is measured through students' final GPA scores. Using non-parametric tests such as the Mann-Whitney U test and Spearman's correlation, the study investigates the relationship between mental health and academic performance. MPC students demonstrated better mental health (Mean rank: 230.75) and higher academic achievement (Mean rank: 262.82) compared to BiPC students. Female students outperformed males in both mental health and GPA across streams, with MPC females achieving the highest scores.

A strong positive correlation (Spearman's $\rho = 0.72$, $p < .05$) was observed between mental health and academic achievement, emphasizing their interdependence. Notably, MPC females exhibited superior performance in mental health and academics, while BiPC males showed marginally higher mental health compared to females.

These findings emphasize the critical role mental well-being plays in shaping academic success and suggest implications for educational strategies that support student's mental health to improve outcomes. The study concludes with recommendations for integrating mental health programs within the Higher Secondary education system.

Keywords: *Mental health, Academic achievement, Higher Secondary students, Grade Point Average*

Introduction

Mental health is a crucial determinant of students' academic success and overall well-being. Adolescents in higher secondary education often face academic pressure, competition, career-related stress, and social expectations that can significantly affect their mental health. Poor mental health may lead to anxiety, depression, reduced concentration, low motivation, and poor academic performance. Conversely, positive mental health supports effective learning, resilience, and academic achievement.

This study investigated the relationship between mental health and academic achievement among Higher Secondary Science and Mathematics stream students in Hyderabad. The research specifically compared students from MPC (Mathematics, Physics, Chemistry) and BiPC (Biology, Physics, Chemistry) streams and examined differences across gender. The study sought to determine whether mental health influences academic performance and whether significant differences exist between groups.

Objectives and Methodology

The study employed a quantitative correlational research design to examine the relationship between mental health and academic achievement. Mental health was measured using the Mental Health Battery developed by Singh and Gupta, while academic achievement was assessed through students' academic records. The sample consisted of higher secondary students from MPC and BiPC streams, including both male and female learners. Statistical techniques such as Spearman's Rank Correlation and Mann–Whitney U tests were used because the data did not follow a normal distribution.

The major objectives were:

1. To compare mental health among MPC and BiPC students.
2. To compare academic achievement among MPC and BiPC students.
3. To examine gender differences in mental health and academic achievement.
4. To investigate the relationship between mental health and academic achievement.
5. To identify stream-wise and gender-wise variations in this relationship.

Major Findings

Mental Health and Academic Achievement

The most significant finding of the study was the strong positive correlation between mental health and academic achievement. Students with better mental health consistently demonstrated higher academic performance. The findings indicate that emotional well-being plays a vital role in academic success. Improved mental health was associated with greater concentration, motivation, confidence, and overall learning effectiveness.

Differences Between MPC and BiPC Students

The study found that MPC students had significantly better mental health than BiPC students. Similarly, MPC students achieved higher academic scores than their BiPC counterparts. These findings suggest that students in the BiPC stream may experience greater academic stress and pressure, which can negatively influence both mental health and academic performance.

Researchers noted that limited practical exposure and intensive academic demands in the BiPC stream may contribute to increased stress and lower performance outcomes.

Gender Differences

The study revealed notable gender-based differences:

- Female students generally exhibited better mental health than male students across the overall sample.
- Female students outperformed male students academically.
- Within the MPC stream, female students demonstrated significantly better mental health and academic achievement than male students.
- In the BiPC stream, male students showed better mental health than female students, although academic achievement differences between genders were not significant.

These findings suggest that gender interacts with academic stream in influencing mental health and achievement outcomes.

Stream and Gender Interactions

Among female students, those in the MPC stream demonstrated significantly higher mental health and academic achievement than females in the BiPC stream. However, among male students, differences between MPC and BiPC groups were not statistically significant.

The study therefore highlights the need to focus particularly on BiPC female students, who appeared to be the most vulnerable group in terms of mental health and academic challenges.

Discussion

The findings reinforce the growing body of evidence that mental health is closely linked to academic achievement. Students with positive mental health are more likely to demonstrate better concentration, self-confidence, problem-solving skills, and resilience. Mental well-being enables learners to cope effectively with academic demands and perform successfully in examinations and classroom activities.

The superior performance of MPC students may be attributed to differences in curriculum structure, learning experiences, and academic expectations. BiPC students often encounter greater pressure due to competitive medical entrance examinations and extensive theoretical and practical requirements. These demands may contribute to elevated stress levels and lower mental health scores.

Gender differences observed in the study suggest that social support systems, coping mechanisms, and educational experiences may influence mental health differently for male and female students. Female students in the MPC stream appeared to benefit from stronger emotional coping strategies and academic engagement, resulting in better mental health and academic outcomes.

The study further demonstrates that mental health support should not be viewed merely as a welfare initiative but as a critical educational strategy for improving student achievement.

Conclusion and Educational Implications

The study concludes that mental health has a significant and positive impact on academic achievement among higher secondary science and mathematics students. Students with higher mental health scores consistently performed better academically. MPC students demonstrated better mental health and academic achievement than BiPC students, while significant gender differences were also observed. Overall, the findings establish mental health as a key predictor of academic success.

Implications for Students

Students should:

- Develop awareness of mental health and its influence on learning.
- Practice stress-management techniques.
- Seek counselling and emotional support when required.
- Participate in extracurricular activities.
- Prioritize self-care and emotional well-being alongside academics.

Implications for Teachers

Teachers should:

- Identify signs of emotional distress among students.
- Create supportive and inclusive classroom environments.
- Integrate mental health awareness into teaching practices.
- Encourage open communication and help-seeking behaviour.
- Participate in professional development related to student mental health.

Implications for Educational Institutions and Policymakers

Schools and educational authorities should:

- Establish counselling and psychological support services.
- Organize mental health awareness programmes.
- Reduce excessive academic pressure.
- Develop stream-specific support systems, particularly for BiPC students.
- Promote holistic education that balances academic achievement with emotional well-being.

Final Remark

The study demonstrates that academic excellence and mental well-being are inseparable. Improving students' mental health can lead to enhanced academic performance, better adjustment, stronger resilience, and overall holistic development. Therefore, educational institutions must prioritize mental health as a central component of quality education.

Mental Health Challenges among Secondary School Students: A Career Selection Pressure

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Abstract

Career selection is a critical developmental task during adolescence. In India, secondary school students often face significant pressure from parents, schools, and society regarding career choices, particularly in highly competitive educational environments. This study examines the impact of career selection pressure on the mental health of secondary school students and explores the role of career guidance in reducing psychological distress.

Using a quantitative research design, data were collected from 95 students of Classes IX and X studying in CBSE and ICSE schools in Hyderabad. Findings revealed that students experience considerable stress, confusion, and anxiety regarding career decisions. Parental expectations, academic competition, and societal emphasis on prestigious careers emerged as major sources of pressure. Most students reported inadequate career guidance and expressed a strong need for structured support systems in schools.

The study concludes that the absence of systematic career guidance contributes significantly to career-related stress and highlights the need for school-based counseling and career development programmes.

Keywords: Mental Health, Career Selection Pressure, Academic Stress, Career Guidance, Secondary School Students

Introduction

Adolescence is a crucial period marked by rapid physical, emotional, social, and cognitive development. During this stage, students begin making important decisions regarding their educational and career paths. In India, career choices are often influenced by societal expectations, parental aspirations, academic competition, and cultural beliefs regarding prestigious professions such as medicine, engineering, and civil services.

Many students face pressure to choose careers that may not align with their interests, abilities, or aspirations. Such pressure frequently results in stress, anxiety, confusion, reduced self-confidence, and fear about the future. Despite growing awareness of adolescent mental health concerns, limited attention has been given to career-related psychological distress among school students.

The lack of structured career guidance programmes in many schools further aggravates this problem. Students often make career decisions based on parental expectations, peer influence, or social prestige rather than informed self-exploration. This study addresses this gap by examining the relationship between career selection pressure and mental health among secondary school students.

Objectives of the Study

The study aimed to:

1. Measure the level of career selection pressure among secondary school students.
2. Identify major sources of career-related pressure.
3. Examine the availability and effectiveness of career guidance.
4. Explore students' emotional responses to career decision-making.
5. Identify support systems preferred by students.

Methodology

The study adopted a quantitative survey design involving students from Classes IX and X studying in CBSE and ICSE schools in Hyderabad.

Sample

A total of **95 students** participated:

- Class X: 70.5%
- Class IX: 29.5%

Gender distribution:

- Female: 63.2%
- Male: 33.7%
- Prefer not to disclose: 3.2%

Research Instrument

A structured questionnaire was used, consisting of four major sections:

1. Demographic information
2. Career awareness and guidance
3. Parental and social expectations
4. Emotional responses and coping mechanisms

The questionnaire included Likert-scale items and Yes/No/Maybe responses. Data were analysed using frequency and percentage distributions.

Ethical considerations such as voluntary participation, confidentiality, and anonymity were maintained throughout the study.

Findings

1. Career Awareness and Guidance

The findings indicate that students possess only moderate levels of career awareness.

- Approximately 43% believed they received adequate information about career options at school.
- Nearly 38% remained neutral regarding the adequacy of career information.
- About 48% agreed that teachers provided some guidance regarding future careers.
- Many students reported that career discussions were not consistently encouraged in schools.

Although nearly 59% expressed confidence in understanding different career paths, a substantial proportion remained uncertain.

These findings suggest that career guidance services in schools are often insufficient and inconsistent, leaving many students unsure about future career opportunities.

2. Parental and Social Expectations

Parental influence emerged as one of the strongest sources of career pressure.

Key findings include:

- Nearly 77% reported that their families frequently discussed career choices.
- About 79% believed that examination performance was crucial for future career success.
- More than 87% felt that society expected them to choose prestigious careers.
- Many students compared their career plans with those of their peers.

These results demonstrate the powerful role of family expectations and societal norms in shaping students' career decisions.

In the Indian context, academic achievement is often viewed as the primary pathway to career success, which can increase pressure and limit exploration of alternative career options.

3. Emotional Reactions to Career Decisions

Career selection was found to have a significant emotional impact on students.

Major findings include:

- 64.2% reported feeling worried when thinking about their future careers.
- 68.5% experienced confusion regarding suitable career choices.
- More than half reported conflicts between their personal interests and others' expectations.
- Many students linked academic performance directly with future career opportunities.

Although some students felt confident about their future plans, a considerable proportion remained uncertain or anxious.

These findings indicate that career-related stress is a widespread concern among secondary school students and may negatively affect their psychological well-being.

4. Need for Career Support

One of the strongest findings was the overwhelming demand for school-based career support.

- Approximately 93.6% believed that students need greater support while making career decisions.

Students recognized the importance of professional guidance in reducing uncertainty and improving confidence regarding career planning.

5. Preferred Coping Resources

Students identified several resources that could assist them in making informed career decisions:

Resource	Percentage
Counselling	32.6%
Workshops	31.6%
Mentorship	17.9%
Online Tools	17.9%

The findings suggest that students prefer personalized, interactive, and face-to-face forms of support rather than relying solely on online resources.

Discussion and Educational Implications

The study reveals that career selection pressure significantly affects the mental health of secondary school students. Many adolescents experience anxiety, confusion, uncertainty, and self-doubt while making career decisions.

Influence of Parents and Society

The results highlight the strong influence of parents and societal expectations on career decision-making. Students often feel compelled to pursue careers that are socially prestigious rather than aligned with their interests and strengths.

Such pressures can lead to:

- Reduced self-confidence
- Identity confusion
- Career indecision
- Lower psychological well-being
- Increased stress and anxiety

Lack of Structured Career Guidance

The findings indicate that many schools do not provide adequate career guidance programmes. Students frequently rely on informal sources such as parents, peers, or social media for career information.

Without professional guidance, students may:

- Develop unrealistic expectations
- Experience greater confusion
- Feel uncertain about future opportunities
- Make poorly informed career decisions

Educational Implications

To address these challenges, schools should:

1. Introduce Structured Career Guidance Programmes

Career education should begin from middle school and continue throughout secondary education.

Programmes should include:

- Career awareness sessions
- Aptitude and interest assessments
- Career planning workshops
- Individual counselling

2. Strengthen School Counselling Services

Schools should appoint trained counsellors who can:

- Support students emotionally
- Assist in career exploration
- Reduce career-related anxiety
- Help students develop realistic career goals

3. Involve Parents

Parent education programmes can help families:

- Understand diverse career opportunities
- Support students' interests
- Reduce excessive pressure
- Encourage informed decision-making

4. Utilize Technology

Digital platforms can expand access to:

- Career information
- Virtual mentorship
- Career assessments
- Professional networking opportunities

This is particularly beneficial for schools with limited resources.

Limitations and Future Directions

The study has several limitations:

- The sample size was limited to 95 students.
- Participants were drawn only from CBSE and ICSE schools in Hyderabad.
- The study relied on self-reported responses.
- The cross-sectional design did not examine changes over time.

Future research should:

- Include larger and more diverse samples.
- Compare students across educational boards and regions.
- Employ qualitative methods such as interviews and focus groups.
- Conduct longitudinal studies to examine changes in career-related stress over time.
- Evaluate the effectiveness of career guidance interventions.

Conclusion

The study demonstrates that career selection pressure is a significant contributor to mental health challenges among secondary school students. Many students experience anxiety, confusion, and uncertainty regarding their future careers, largely due to parental expectations, societal pressure, academic competition, and inadequate career guidance.

A substantial majority of students expressed the need for stronger school-based support systems. The findings emphasize that career guidance should be regarded as an essential component of secondary education rather than an optional service.

Schools, parents, counsellors, and policymakers must work collaboratively to establish comprehensive career development programmes that support students' emotional well-being and informed career decision-making. By providing appropriate guidance, counselling, and opportunities for self-exploration, schools can help transform career decision-making from a source of stress into a process of confidence, growth, and empowerment.

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Sustainable Development Goals and Transformative Education: Advancing Inclusive and Equitable Quality Education for a Sustainable Future

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Abstract

The United Nations introduced the Sustainable Development Goals (SDGs) in 2015 as a global framework to address pressing challenges such as inequality, environmental degradation, poverty, and inaccessible quality education. Among these seventeen SDGs, education (Goal 4) plays a central role in building a more just, sustainable, and prosperous future. Education is not only a goal in itself but also a powerful means for achieving progress across all other areas of sustainable development. This paper focuses on four key dimensions: education for sustainable development, inclusive and equitable quality education, environmental education and global citizenship, and community engagement. Education for sustainable development equips learners with the knowledge, values, and skills necessary to make responsible decisions for a better future. It encourages critical thinking, problem-solving, and promotes awareness about social, economic, and environmental issues, enabling students to become agents of positive change in their communities and beyond.

Inclusive and equitable quality education ensures that all individuals, regardless of their socio-economic status, gender, ethnicity, or ability, have access to meaningful and high-quality learning opportunities. It highlights the importance of reducing disparities, promoting gender equality, and creating equal opportunities for all learners. Environmental education and global citizenship further strengthen this approach by fostering a sense of collective responsibility towards the planet and encouraging individuals to act as informed, empathetic, and active global citizens. These dimensions are essential for preparing students to address complex global challenges such as climate change and social injustice. Community engagement acts as a bridge between education and real-world application. By fostering partnerships between schools, families, and local organizations, it promotes collaboration and shared responsibility for sustainable development.

Learners gain hands-on experience, participate in sustainable practices, and contribute to community development, which helps reinforce the values and knowledge acquired in the classroom. Such engagement ensures that educational outcomes are relevant and impactful, driving long-term positive change within society. In conclusion, achieving the Sustainable Development Goals is a complex challenge that requires a collective and sustained effort from governments, educators, communities, and individuals. Education serves as a powerful tool for transformation, empowering people with the knowledge and skills needed to create lasting social, economic, and environmental progress. By integrating these key aspects—education for sustainable development, inclusion and equity, environmental awareness, global citizenship, and community engagement—into educational practices, societies can lay the foundation for a more inclusive, aware, and sustainable future for generations to come.

Keywords: Sustainable Development Goals, Inclusive Education, Environmental Education, Global Citizenship, Community Engagement

Introduction

Education is widely recognized as a fundamental human right and a powerful instrument for social transformation and sustainable development. In today's interconnected world, education extends beyond the transmission of knowledge and plays a vital role in shaping values, attitudes, and competencies necessary for responsible citizenship.

The adoption of the Sustainable Development Goals (SDGs) by the United Nations in 2015 represented a global commitment to addressing major challenges such as poverty, inequality, climate change, and lack of educational opportunities. Among the seventeen goals, **SDG 4—Quality Education**—occupies a central position because education contributes directly and indirectly to the achievement of all other SDGs.

Education plays a dual role in sustainable development. It is both a goal in itself and a means for achieving broader social, economic, and environmental objectives. A well-educated population is better equipped to make informed decisions, participate actively in society, and contribute to sustainable development.

Despite significant progress in educational access, disparities continue to exist due to factors such as socio-economic status, gender, disability, geographical location, and cultural background. These inequalities restrict opportunities and hinder social progress. Therefore, educational systems must focus on inclusion, equity, sustainability, and lifelong learning.

This paper explores four interconnected dimensions:

1. Education for Sustainable Development (ESD)
2. Inclusive and Equitable Quality Education
3. Environmental Education and Global Citizenship
4. Community Engagement

Together, these dimensions provide a holistic framework for achieving sustainable and transformative education.

Methodology

This study adopts a **qualitative and descriptive research approach** based entirely on secondary sources. Information was collected from:

- UNESCO reports and publications
- United Nations documents
- Research journals
- Educational policy documents
- Scholarly books and articles related to SDGs and education

Methods of Analysis

The study employed **thematic analysis** to identify and examine major themes emerging from the literature. The themes included:

- Sustainability
- Inclusion and equity
- Environmental awareness
- Global citizenship
- Community participation

This approach enabled a comprehensive understanding of how education contributes to sustainable development while maintaining academic credibility through reliance on established research and policy frameworks.

Findings

1. Education for Sustainable Development (ESD)

Education for Sustainable Development is an educational approach that integrates sustainability principles into teaching and learning processes. It aims to empower learners with the knowledge, skills, values, and attitudes needed to contribute to a sustainable future.

ESD promotes:

- Critical and reflective thinking
- Problem-solving abilities
- Responsible decision-making
- Awareness of environmental and social issues
- Ethical and sustainable behaviour

Research shows that ESD encourages interdisciplinary learning by connecting classroom knowledge with real-world challenges. It helps learners understand the interconnected nature of environmental, social, and economic issues and prepares them to address global challenges effectively.

By fostering sustainability-oriented competencies, ESD enables learners to become active agents of change within their communities and societies.

2. Inclusive and Equitable Quality Education

Inclusive and equitable education seeks to ensure that every learner has access to meaningful educational opportunities regardless of background, gender, ability, or socio-economic status.

Key aspects include:

- Removal of physical, social, and economic barriers
- Promotion of gender equality
- Support for learners with disabilities

- Culturally responsive teaching
- Equal access to educational resources

Inclusive education recognizes diversity as a strength rather than a challenge. It focuses not only on access but also on meaningful participation and successful learning outcomes.

Studies indicate that inclusive educational environments improve academic achievement, social integration, and mutual respect among learners. However, challenges such as inadequate infrastructure, insufficient teacher training, and societal prejudices continue to limit effective implementation.

To achieve SDG 4, education systems must ensure that all learners receive equitable support and opportunities to succeed.

3. Environmental Education and Global Citizenship

Environmental education helps learners understand ecological issues and develop sustainable behaviours. It promotes awareness of climate change, biodiversity conservation, resource management, and environmental protection.

The major objectives of environmental education include:

- Understanding environmental challenges
- Promoting sustainable lifestyles
- Encouraging responsible use of resources
- Developing environmental stewardship

Global Citizenship Education (GCED) complements environmental education by fostering:

- Awareness of global interdependence
- Respect for diversity and human rights
- Social responsibility
- Commitment to peace and justice

Together, environmental education and global citizenship prepare learners to become informed, responsible, and active members of both local and global communities.

They encourage learners to view themselves as contributors to collective solutions for global challenges such as climate change, inequality, and social injustice.

4. Community Engagement

Community engagement strengthens the relationship between education and society by encouraging collaboration among schools, families, local organizations, and community members.

Through community engagement, learners gain opportunities to apply classroom knowledge to real-life situations. Activities such as environmental campaigns, community service, awareness programmes, and sustainability projects provide practical learning experiences.

Benefits of community engagement include:

- Enhanced experiential learning
- Development of civic responsibility
- Improved school-community relationships
- Promotion of collaborative problem-solving
- Increased student motivation and participation

Strong community partnerships help ensure that education remains relevant, responsive, and capable of addressing local and global challenges.

Discussion

The findings highlight that achieving inclusive and equitable quality education requires a comprehensive and multidimensional approach. Education systems must move beyond traditional rote learning and focus on developing learners who are critical thinkers, responsible citizens, and active contributors to sustainable development.

Interconnection of Key Dimensions

The four dimensions explored in this study are closely interconnected:

- Inclusive education ensures access and participation.
- ESD provides meaningful sustainability-focused learning.
- Environmental education develops ecological awareness.
- Global citizenship promotes social responsibility.
- Community engagement enables practical application.

Together, these dimensions create a holistic educational framework that supports sustainable development.

Role of Teachers

Teachers play a central role in implementing inclusive and sustainable educational practices. Their responsibilities include:

- Creating inclusive learning environments
- Using learner-centred teaching approaches
- Promoting critical thinking and participation
- Encouraging collaboration and respect
- Integrating sustainability concepts into teaching

However, many educators lack adequate training and resources to implement these approaches effectively. Continuous professional development is therefore essential.

Challenges in Implementation

Despite supportive policies and international commitments, several challenges continue to hinder progress:

- Limited financial resources
- Inadequate infrastructure
- Socio-economic inequalities
- Digital divide and technological barriers
- Insufficient teacher preparation
- Resistance to educational change

Addressing these challenges requires coordinated efforts from governments, educational institutions, communities, and policymakers.

Educational Implications

To strengthen inclusive and sustainable education, the following measures are recommended:

- Curriculum reforms integrating sustainability and inclusion
- Comprehensive teacher training programmes
- Increased use of educational technology for accessibility
- Strengthened community participation
- Policy support for marginalized and disadvantaged learners

Educational institutions must adopt innovative, flexible, and learner-centred approaches that address the diverse needs of students.

Conclusion

Education is a powerful instrument for achieving sustainable development and social transformation. The successful realization of SDG 4 requires educational systems that are inclusive, equitable, sustainable, and responsive to contemporary global challenges.

This study highlights the importance of integrating Education for Sustainable Development, inclusive education, environmental awareness, global citizenship, and community engagement into educational practice. Together, these dimensions create learning environments that empower individuals, promote social justice, and support sustainable development.

Achieving inclusive and equitable quality education is not solely the responsibility of educational institutions; it requires collective action from governments, educators, communities, and individuals. Through sustained commitment and collaborative efforts, education can serve as a transformative force for building a more just, inclusive, and sustainable future for all.

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Integration of AI in Instruction

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Abstract

Artificial Intelligence (AI) is transforming modern education by reshaping teaching practices, learning environments, and classroom engagement. In the United States, AI supported teaching and learning models are widely integrated with digital platforms that streamline access to instructional resources and assessments. Learning management systems such as Canvas and Microsoft Teams allow teachers to upload digital textbooks, assignments, recorded lectures, and supplementary materials in one centralized location. Through these platforms, students and parents can easily access course resources, review grades, track progress, and communicate with teachers. In addition, recorded lessons and educational videos from YouTube can be embedded within course modules, enabling students to revisit complex topics and prepare effectively for examinations.

Adaptive learning technologies also enhance personalized instruction. Platforms such as Way ground provide interactive presentations, embedded assessments, and “check for understanding” questions that help teachers evaluate student comprehension during lessons. Similarly, Nearpod supports digital pedagogy through differentiated instruction, interactive videos, and real time formative assessments. Many school districts have also developed digital textbook applications that integrate reading materials, adjustable text sizes for differentiation, assessment, and simulation-based activities that promote research-oriented learning.

The availability of school provided laptops has further strengthened technology enhanced learning by enabling students to access digital tools daily, promoting deeper understanding and mastery. At the same time, ethical challenges arise from the growing use of AI tools such as ChatGPT and Microsoft Copilot. To address this, some districts have introduced monitored systems like School AI to guide responsible AI use. These innovations illustrate how AI can support ethical, personalized, and future-ready classrooms.

Keywords: Adaptive learning, artificial intelligence, digital platforms, personalized instruction, technology enhanced learning

Introduction

Artificial Intelligence (AI) has emerged as a transformative force in education, reshaping teaching methodologies, learning environments, and student engagement. In U.S. schools, AI-supported instructional systems are increasingly integrated into digital learning platforms that centralize educational resources, assessments, communication, and progress monitoring. Learning Management Systems (LMS) such as Canvas and Microsoft Teams enable teachers to provide digital textbooks, assignments, recorded lectures, and supplementary materials while allowing students and parents to track academic progress and access learning resources conveniently.

AI-driven educational technologies support personalized learning by adapting instructional content to individual student needs. Platforms such as Nearpod and Wayground (formerly Quizizz) facilitate interactive teaching through formative assessments, multimedia resources, and differentiated instruction. The widespread availability of school-issued laptops has further enhanced access to these technologies, enabling students to engage with digital learning tools regularly. However, the growing use of AI tools such as ChatGPT and Microsoft Copilot also raises ethical concerns regarding academic integrity, responsible use, and data privacy.

Adaptive Learning and AI in Classroom Instruction

Adaptive learning technologies employ artificial intelligence, machine learning, and learning analytics to personalize educational experiences. These systems continuously collect and analyze learner data, adjusting instructional content, pacing, and difficulty levels according to students' individual learning needs. Research indicates that students who use adaptive learning systems often demonstrate higher engagement levels and improved academic achievement compared to those receiving traditional instruction.

AI supports teachers in several ways:

- Automating formative assessments.
- Generating differentiated instructional materials.
- Identifying learning gaps quickly.
- Providing real-time feedback.
- Supporting personalized learning pathways.

These capabilities allow educators to devote more attention to facilitation, mentoring, and meaningful interactions with students while reducing routine administrative tasks.

AI-Enhanced Educational Technologies

1. PhET Interactive Simulations

PhET Interactive Simulations, developed by the University of Colorado Boulder, are widely used in science and mathematics classrooms. These simulations transform abstract concepts into visual and interactive experiences, encouraging inquiry-based learning and conceptual understanding. Rather than receiving information passively, students actively explore scientific and mathematical principles through experimentation and discovery.

Research highlights several benefits of PhET simulations:

- Improved conceptual understanding in science and mathematics.
- Increased student motivation and engagement.
- Support for inquiry-based and standards-aligned instruction.
- Enhanced understanding of difficult concepts such as electricity, forces, chemical reactions, and fractions.

2. Nearpod for Interactive Teaching

Nearpod is an interactive instructional platform that integrates slides, videos, quizzes, polls, simulations, and formative assessments into classroom teaching. It supports whole-class, small-group, and individualized instruction, making learning more engaging and responsive.

Key benefits include:

- Increased student participation and attentiveness.
- Instant formative assessment data.
- Enhanced conceptual understanding through multimedia learning.
- Improved teacher ability to monitor student progress in real time.

Nearpod's integration of visual, auditory, and interactive elements helps create rich learning experiences that cater to diverse learning styles.

3. Wayground (Formerly Quizizz)

Wayground has evolved into an AI-powered instructional and assessment platform used extensively across U.S. schools. It combines assessment, engagement, differentiation, and instructional planning within a single ecosystem.

Major instructional benefits include:

- AI-generated lessons and assessments.
- Automatic differentiation and accommodations.
- Real-time performance analytics.
- Immediate identification of misconceptions.

These features enable teachers to adjust instruction promptly and provide targeted support to learners.

4. Instructional Videos and Multimedia Learning

AI-supported multimedia tools have expanded opportunities for flexible learning. Instructional videos integrated into platforms such as Nearpod and Wayground allow students to revisit lessons multiple times, enhancing understanding and retention. AI features such as automatic captioning, summarization, annotation, and pause-and-review functions further improve accessibility and learning outcomes.

Multimedia learning supports the principles of dual coding theory, where visual and auditory information work together to strengthen comprehension and memory.

AI for Differentiated and Inclusive Instruction

One of the most significant contributions of AI in education is its ability to support differentiated instruction. Modern AI platforms such as Magic School AI, Eduaide.AI, LearningFlow.AI, and ChatGPT-based tools assist teachers in addressing diverse learner needs.

These platforms can:

1. Simplify or enrich instructional texts.
2. Generate materials at varying difficulty levels.
3. Create personalized learning pathways.
4. Develop choice boards and scaffolded activities.
5. Provide individualized feedback.

AI-driven differentiation aligns with Universal Design for Learning (UDL) principles by ensuring that all learners, including those with special educational needs, can access and engage with curriculum content effectively.

By supporting inclusive education, AI helps teachers accommodate diverse learning abilities, interests, and learning styles while maintaining high academic expectations.

Discussion, Challenges, and Future Directions

Educational Impact

The integration of AI and adaptive learning technologies has made classroom instruction more efficient, engaging, and student-centered. Tools such as PhET, Nearpod, and Wayground promote conceptual clarity by presenting content in multiple formats, providing immediate feedback, and supporting self-paced learning. These technologies help bridge learning gaps and enhance student understanding across various subjects.

AI contributes to learning by:

- Presenting concepts through multiple representations.
- Providing instant clarification and feedback.
- Supporting mastery learning and self-paced progression.
- Enhancing engagement and participation.

When combined with effective teaching practices, AI technologies create dynamic and learner-centered educational environments.

Educational Limitations

Despite its numerous benefits, AI integration presents several challenges:

1. Digital access and equity concerns.
2. Teacher readiness and professional development needs.
3. Data privacy and ethical issues.
4. Risks associated with overreliance on automation.

Researchers emphasize that AI should complement rather than replace human teaching. Teachers remain essential for fostering critical thinking, creativity, social-emotional development, and ethical decision-making. Professional development is therefore crucial to ensure effective and responsible technology integration.

Future Directions

Future developments in AI-enhanced education should focus on:

- Ethical and explainable AI systems.
- Stronger alignment with curriculum standards.
- Expanded use of augmented and virtual reality technologies.
- Integration of social-emotional learning with AI-supported instruction.
- Evidence-based implementation guided by educational research and policy.

These directions will help ensure that AI continues to support meaningful, equitable, and sustainable educational innovation.

Conclusion

Artificial Intelligence and adaptive learning technologies are significantly transforming teaching and learning in contemporary classrooms. Digital tools such as PhET simulations, Nearpod, Wayground, instructional videos, and AI-powered differentiation platforms improve conceptual understanding, engagement, assessment, and personalized instruction. These innovations support inclusive and student-centered learning environments while enhancing instructional effectiveness.

However, successful implementation requires attention to ethics, teacher training, equitable access, and responsible use. When thoughtfully integrated, AI has the potential to create future-ready classrooms that support the success of every learner.

A Study on Mid-Day Meal Program

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Abstract

The Mid-Day Meal (MDM) Program, a major school-based nutrition initiative in India, aims to enhance students' health and educational outcomes. This study assesses students' and teachers' satisfaction with the MDM program in government secondary schools in urban Hyderabad, Telangana.

Using a quantitative survey method, data were collected from 120 students and 34 teachers through structured questionnaires, and results were analysed using an independent samples t-test. Findings revealed overall positive perceptions of the program's impact on nutrition, attendance, and classroom engagement. Female students and teachers reported higher satisfaction, particularly with hygiene and punctuality.

However, issues such as limited meal variety, occasional food quality problems, and inadequate infrastructure were noted. The study emphasises the need for community participation, staff training, and regular monitoring to enhance implementation. Overall, the MDM program plays a vital role in promoting child nutrition, learning outcomes, and social equity.

Keywords: Mid-day meal, program.

Introduction:

The Mid-Day Meal (MDM) Scheme, now known as the PM POSHAN (Pradhan Mantri Poshan Shakti Nirman) Scheme, is India's flagship school meal program aimed at improving the nutritional and educational outcomes of children in government and government-aided schools. It provides free cooked lunches on school days to over 120 million children across more than 1.27 million institutions, making it the world's largest school-based feeding initiative. The program originated in Tamil Nadu during the pre-independence period (1925) and was formally implemented across India after the Supreme Court's 2001 order directing all states to provide cooked meals in schools. Initially launched as the National Programme of Nutritional Support to Primary Education (NP-NSPE) in 1995, it later evolved into the National Programme of Mid-Day Meals in Schools, now integrated under the National Food Security Act, 2013.

The scheme aims to enhance school enrollment, attendance, and retention, particularly among children from economically disadvantaged and marginalised groups. It also helps reduce malnutrition and classroom hunger, contributing to better health, concentration, and academic performance. Nutritional entitlements ensure 450–700 calories and 12–20 grams of protein per child daily. Implementation follows both decentralised and centralised models. In rural areas, meals are cooked on-site by local women, creating employment opportunities and promoting community participation. In urban regions, NGOs like the Akshaya Patra Foundation operate large-scale centralised kitchens. Financially, the Central Government bears 60% of the cost, with the remainder covered by the states. Initiatives such as "TithiBhojan" encourage public participation, where communities contribute meals or resources during special occasions. Monitoring committees operate from the national to the school levels to ensure quality and compliance. Despite these measures, challenges persist — including issues of food quality, hygiene, infrastructure shortages, fund delays, and occasional corruption.

Research and evaluation studies show the MDM scheme's significant impact on education, nutrition, gender equality, and social inclusion. It has improved enrollment and attendance, particularly among girls and children from lower castes, while reducing dropout rates. The program also empowers rural women through employment as cooks and helpers. However, disparities in implementation across states and incidents of food contamination highlight the need for stronger monitoring, infrastructure improvement, and transparency. Overall, the

Mid-Day Meal Scheme remains a vital tool for promoting education, nutrition, and social equity among India's children.

Significance of the study:

This study on the Mid-Day Meal (MDM) Program highlights its vital role in improving children's education, nutrition, and social development in government schools. Assessing the satisfaction of students and teachers it provides insights to strengthen the program's effectiveness and guide future policy decisions. Educationally, the MDM scheme increases enrollment, attendance, and retention, particularly among girls and disadvantaged groups, while improving classroom concentration and learning outcomes through better nutrition. Nutritionally, it combats malnutrition and micronutrient deficiencies, ensuring children receive essential daily nourishment that supports healthy growth.

Socially, the program promotes gender equality and social inclusion by encouraging girls' education and enabling children of different backgrounds to share meals, fostering unity and mutual respect. Economically, it generates employment opportunities for women and supports local farmers through decentralised food procurement, contributing to community development. Aligned with Sustainable Development Goals (SDGs) on zero hunger, health, and quality education, the MDM program emerges as a key instrument for advancing human development and social equity. The study's findings can help improve implementation, ensuring the program continues to nurture both the health and learning of India's children.

Objectives:

- To study the satisfaction level of the Mid-day meal program among students of Government schools.
- To analyse the Satisfaction level of the Mid-day meal program among boys and girls of government schools.
- To examine the satisfaction level of male and female government teachers with the midday meal program in government schools.

Review of literature:

Singh and Mishra (2010) in “Mid-day Meal Program in Meghalaya” found that there was a lack of awareness among the masses regarding the Mid-day Meal scheme. There was a need for monitoring and basic infrastructure facilities to overcome lacunas.

Paindla Prasad (2010) collected the opinion of primary school children towards the Mid-day Meal Scheme in Warangal District and found that the attendance of students in each class was increased, the enrolment rate was also hiked, and the dropout rate was reduced tremendously. Children belonging to all castes were socialised, which led to a decrease in caste-based discrimination. The children opined that the program should continue forever.

Gupta (2008) found that in Uttarakhand, the Bhojan Mata concept was poorly implemented, with workers treated as wage employees and weak coordination between administrative levels.

Srinivas (2008), studying Karnataka, highlighted good practices such as kitchen gardens, use of LPG, women cooks from marginalised groups, and community monitoring, recommending stronger local committees and external evaluations.

Singh (2008) reported that the scheme improved children’s nutrition (height and weight gains) and learning outcomes, especially in drought-affected areas, showing the MDM program’s strong role in reducing malnutrition and enhancing education.

Research Methodology:

Research Approach: Quantitative Research design is used for this study.

Data collection: The sample was collected from the students and teachers of government secondary schools of Hyderabad district through Random Sampling method.

Statistical Analysis method:

An independent samples t-test was applied to identify differences in satisfaction levels between male and female students and teachers.

Data Analysis and Interpretation:

Both students and teachers expressed positive satisfaction with the MDM scheme, recognising it as beneficial in improving attendance, nutrition, and classroom participation.

Gender-Based Differences:

- **Students:** Girls showed higher satisfaction than boys, especially concerning meal hygiene, punctuality, and variety.
- **Teachers:** Female teachers reported greater satisfaction with the program's impact on students' attentiveness and health.

Nutritional and Educational Impact:

The MDM program effectively reduced classroom hunger and improved nutritional status, which translated into better focus and learning outcomes.

Operational Challenges:

Respondents pointed out issues such as inconsistent food quality, lack of meal variety, inadequate kitchen infrastructure, and delays in fund allocation.

Recommendations:

The study suggests improved monitoring, community involvement, and training for cooks and helpers to strengthen program efficiency and sustainability.

Discussion:

The study found that the Mid-Day Meal (MDM) Program positively influences students' nutrition, attendance, and classroom engagement. Both students and teachers acknowledged its role in reducing hunger and improving focus. Girls and female teachers showed higher satisfaction, especially regarding hygiene and punctuality. These findings align with previous studies confirming MDM's nutritional and educational benefits. However, challenges such as poor infrastructure, delayed funds, and limited meal variety hinder effective implementation. Strengthening monitoring, community participation, and resource management is essential to sustain and enhance the program's impact on health, learning, and social inclusion.

Implications:

The study shows that the Mid-Day Meal (MDM) Program significantly improves student attendance, retention, and learning, highlighting the need to link nutrition with education. Strengthening monitoring, hygiene, and fund management is essential for effective implementation. Policymakers should focus on infrastructure improvement, staff training, and gender-sensitive expansion of the scheme. The program also promotes social inclusion and equality, suggesting greater community participation to sustain its educational and social benefits.

Conclusion:

The study concludes that the Mid-Day Meal (MDM) Program has a strong positive impact on students' nutrition, health, attendance, and classroom participation in government schools. Both students and teachers expressed general satisfaction with the scheme's role in reducing hunger and improving learning outcomes. Girls and female teachers showed higher satisfaction, particularly regarding hygiene and punctuality.

However, challenges such as poor infrastructure, limited meal variety, and delayed fund disbursement persist. The study emphasises the need for better monitoring, community involvement, and staff training to enhance implementation. Overall, the MDM program remains a vital tool for promoting education, nutrition, and social equity among schoolchildren in India.

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A Study on the Influence of ChatGPT among Students and Teachers of Higher Education Institutions

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Abstract

The rapid growth of artificial intelligence (AI) has introduced new opportunities and challenges in the field of higher education. Among the most influential AI tools is ChatGPT, a conversational language model developed by OpenAI, which is increasingly being adopted by both students and teachers for academic purposes. This study investigates the influence of ChatGPT on teaching and learning in higher education institutions, with a particular focus on whether gender plays a role in shaping its impact.

A quantitative research approach was employed, using a descriptive survey method with structured Likert-scale questionnaires administered to students and teachers from three colleges in Hyderabad. The collected data were analyzed using statistical tools such as mean, standard deviation, and t-tests. The results revealed no significant difference in the influence of ChatGPT between boys and girls, or between male and female teachers. This suggests that the adoption and perceived usefulness of ChatGPT in higher education are largely independent of gender differences.

The findings highlight ChatGPT's potential as an inclusive educational tool that supports both teaching and learning by offering personalized assistance, reducing educators' workload, and enhancing student engagement. At the same time, the study acknowledges concerns regarding academic integrity, ethical use, and over-dependence on AI systems.

Overall, this research contributes to the growing body of knowledge on AI in education by demonstrating that ChatGPT can serve as a neutral and equitable tool, benefitting diverse learners and educators alike. It also provides practical insights for policymakers and institutions seeking to integrate AI responsibly into higher education.

Keywords: ChatGPT, Artificial Intelligence, Higher Education, Teaching, Learning

Introduction

ChatGPT, short for *Chat Generative Pre-Trained Transformer*, is an advanced AI-based language model created by OpenAI that simulates human-like conversation. It represents a major breakthrough in natural language processing (NLP), allowing machines to comprehend and produce meaningful text. Within education, ChatGPT is reshaping teaching and learning by serving as a research assistant, writing tutor, and teaching support tool.

Its adaptability allows students to clarify concepts, improve writing, and receive instant feedback, while teachers use it for lesson preparation, material generation, and evaluation support. However, its widespread adoption raises questions about plagiarism, critical thinking, and ethical boundaries. Hence, this study explores ChatGPT's influence on students and teachers in higher education, focusing on gender differences and overall academic impact.

Significance of the Study:

This research holds importance in assessing ChatGPT's transformative role in higher education. It explores how AI can enhance personalized learning, streamline teaching, and improve institutional efficiency while addressing ethical and social implications.

Key points of significance include:

1. **Personalized Learning:** ChatGPT supports individualized academic assistance, enabling students to learn at their own pace.
2. **Teacher Efficiency:** It aids teachers in automating routine tasks like grading, feedback, and content creation.
3. **Ethical Awareness:** The study provides insights into preventing plagiarism and ensuring responsible AI use.
4. **Institutional Guidance:** The findings help higher education institutions create AI policies and training programs.
5. **Inclusivity:** ChatGPT can reduce learning disparities by providing equal access to academic support.

Objectives of the Study:

1. To analyze the influence of ChatGPT among boys and girls in the higher education system.
2. To study the influence of ChatGPT among male and female teachers in higher education institutions.

Hypotheses:

- H₀₁: There is no significant difference in the influence of ChatGPT among boys and girls.
- H₀₂: There is no significant difference in the influence of ChatGPT among male and female teachers.

Review of Literature:

- Al-Mughairi, H., & Bhaskar, P. (2023). Exploring the factors affecting the adoption of AI techniques in higher education: Insights from teacher's perspectives on ChatGPT. The study reveals critical motivating and inhibiting factors influencing teacher's adoption of ChatGPT in education, highlighting its potential to enhance teaching practices. These insights contribute significantly to the understanding of AI integration in educational settings.
- Sok, S., & Heng, K. (2024). Opportunities, challenges, and strategies for using ChatGPT in higher education. The article concludes that while ChatGPT offers significant opportunities for enhancing education, it also poses challenges related to academic integrity and over dependence on AI. It advocates for developing effective strategies and policies to integrate ChatGPT responsibly in higher education.

Research Methodology:

Approach: Quantitative Research Design, Comparative Analysis method is used for this study.

Population: Students and teachers in the higher education institutions of Hyderabad

Sample: 40 boys, 40 girls (students), 17 male, and 17 female teachers were selected through random sampling method.

Statistical Methods : Mean, Standard Deviation (SD), and *t*-test

Data Analysis and Interpretation:

Level of influence of ChatGPT among boys and girls of higher education institutions.

Students(Higher Education)	n	Mean	Standard Deviation	Standard Error Mean
BOYS	40	79.32	9.59	1.52
GIRLS	40	78.08	9.45	1.49

Interpretation: The data was collected from 40 boys and 40 girls in higher education institutions. The mean of boys' scores was 79.32, and of girls was 78.08. The standard deviation values were 12.29 and 9.83, respectively.

Hypothesis1: There is no significant difference in the influence of ChatGPT among boys and girls in higher education institutions.

n	df	α (level of significance)	t _{cal}	t _{critical}	Result
80	78	0.05	0.50	1.99	HoAccepted

Interpretation: It can be interpreted that there is no significant difference in the influence of ChatGPT between boys and girls in higher education. Since the calculated t-value (0.50) is less than the critical value at the 0.05 level of significance, the variation between boys and girls is not statistically significant. This indicates that ChatGPT has influenced students in higher education equally, irrespective of gender.

Result: No significant difference between boys and girls.

Examine the influence of ChatGPT on male and female teachers of higher education institutions.

Teachers(Higher education)	N	Mean	Standard deviation	Standard error mean
Male Teachers	17	63.53	10.70	2.59
Female Teachers	17	62.00	12.30	2.98

Interpretation: The data was collected from 17 male teachers and 17 female teachers. The mean of male teachers' scores was 63.53, while the mean of female teachers was 62.00. The standard deviations were 13.89 and 18.49, respectively.

Hypothesis 2: There is no significant difference in the influence of ChatGPT among male and female teachers of higher education institutions.

n	df	α (level of significance)	tcal	tcritcl	Result
34	32	0.05	0.27	2.021	HoAccepted

Interpretation: It can be interpreted that there is no significant difference in the influence of ChatGPT between male and female teachers in higher education. The calculated t -value (0.27) is much lower than the critical value at the 0.05 level of significance. This indicates that both male and female teachers are equally influenced by ChatGPT, showing that gender does not play a major role in shaping their perceptions.

Result: No significant difference between male and female teachers.

Interpretation:

Gender does not significantly affect perceptions of ChatGPT. Both students and teachers reported similar influence levels, confirming the neutrality of AI adoption in higher education.

Discussion:

The findings demonstrate that ChatGPT influences students and teachers positively, regardless of gender. Both groups found it useful for learning enhancement, time management, and academic productivity. Students appreciated its instant guidance and explanations, while teachers recognized its utility in instructional support.

However, issues like plagiarism, over-dependence, and data privacy need attention. The findings align with existing literature emphasizing ChatGPT's balanced benefits and challenges. The study suggests that integrating AI tools responsibly can improve academic performance while maintaining ethical standards.

Implications of the Study:

1. **Pedagogical Implications:** ChatGPT can serve as a supplementary digital tutor, improving interaction and engagement.
2. **Administrative Implications:** Institutions should develop AI literacy programs and establish usage policies.
3. **Ethical Implications:** Awareness workshops can help prevent misuse and ensure academic honesty.
4. **Technological Implications:** ChatGPT can bridge gaps in blended and distance learning environments.

Conclusion:

The study concludes that ChatGPT is a valuable educational innovation that enhances both teaching and learning experiences. Gender does not influence the acceptance or effectiveness among students and teachers.

While ChatGPT improves access to knowledge and teaching efficiency, concerns about ethical use, originality, and AI dependence must be addressed through policy and awareness. Overall, it stands as a neutral, equitable, and transformative tool for modern higher education.

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Redefining Leadership In The Digital Age Of Higher Education

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Abstract

The rapid changes in higher education driven by digital technologies have greatly altered the roles and responsibilities of institutional leaders. In a time marked by online learning, data-driven decision-making, and new technologies, leadership in higher education must move beyond outdated administrative methods. Redefining leadership is crucial because it helps institutions navigate technological change while maintaining academic quality, inclusivity, and student involvement. Despite growing conversations about digital transformation in universities, there is a clear research gap on how leadership approaches need to change to manage technology integration and shifting institutional needs effectively.

The objective of this study is to explore how leadership practices in higher education are being redefined in the digital age and to identify the key competencies required for effective leadership in technologically advanced academic settings. The qualitative research approach was used, and a literature review and analysis of contemporary leadership frameworks in higher learning institutions were conducted.

The research aims to synthesize current scholarly research findings and identify emerging leadership trends and strategies in the process of digital transformation. Some of the key findings include that effective leadership in the digital age demands visionary thinking, technological awareness, collaborative decision-making, and adaptive governance structures. The culture of innovation, learning, and digital literacy among faculty and students must be encouraged. The study suggests that higher education institutions should invest in programs that develop their employees' leadership skills in digital competence, strategic foresight, and change management. The need to redefine leadership in the above-mentioned context is crucial to ensuring the sustainability of higher education institutions' growth.

Keywords: change management, digital transformation, leadership competencies, strategic foresight, technological awareness.

Introduction

The development of digital technology has impacted almost all sectors of society, including education. Digital technology has been widely applied in institutions of higher learning to enhance educational processes such as teaching, learning, research, and administration. The evolution of online learning, artificial intelligence, virtual learning environment, and big data analysis has revolutionized knowledge production, dissemination, and consumption.

As the education industry transforms to adapt to the new environment, the styles of leadership are evolving rapidly too. The previous style of leadership, characterized by rigidity in terms of policies, cannot cope with the rapid evolution of digitalization. While digitalization presents opportunities for inclusivity and greater access, there are challenges such as the digital divide, lack of acceptance, and the need for continuous adaptation of technologies.

According to Ulf-Daniel Ehlers, digital leadership means strategically connecting technology with the institution's vision, which requires leaders to rethink traditional educational models. In a similar vein, Michael Fullan argues that effective leadership today must emphasize innovation, collaboration, and continuous improvement.

Another factor that indicates the importance of developing digital capabilities among leaders is the increasing significance of technologies. Leaders should understand the impact of technology on the process of teaching, engagement of learners, and management in educational establishments. Moreover, it is important for leaders to encourage faculty members in adopting digital teaching techniques.

However, regardless of these developments, many educational institutions continue to rely on leadership theories that have become outdated in the context of the digital era. This situation makes it necessary to conduct studies regarding the changes in the concept of leadership in the digital age.

Objectives of the Study:

1. To analyze the impact of digital transformation on leadership in higher education.
2. To identify key competencies required for digital leadership.
3. To explore strategies for effective leadership in digitally driven institutions.

Research Methodology:

Research Design:

The current study uses a qualitative conceptual research approach following the analysis of past literature. This paper seeks to identify theoretical and empirical evidence on digital leadership in higher education institutions.

Data Collection:

Data were collected from credible academic sources, including:

- Peer-reviewed journals (Scopus, Web of Science)
- Books on educational leadership
- Reports from international organizations
- Conference papers and scholarly articles

Databases such as Google Scholar, Springer, Elsevier, and ResearchGate were used to access relevant literature.

Data Analysis

The research uses thematic analysis to determine important trends and concepts. The literature has been critically analyzed and grouped into themes according to topics concerning digital leadership.

Findings:

• Digital Competence as a Core Leadership Skill

Digital literacy is a crucial characteristic that leaders in higher education should have. Leaders should be digitally literate by having an understanding of how to use new technologies.

• Strategic Vision and Institutional Alignment

Successful digital transformation requires a clear strategic vision. Leaders must align technological initiatives with institutional goals and ensure that digital innovation enhances academic quality.

• Collaborative and Distributed Leadership

The digital transformation process needs a strong strategic vision. The leadership must integrate the technology process into the institutional objectives and ensure that innovation is used to improve the academic excellence.

• Innovation and Change Management

Digitalization facilitates cooperation amongst the stakeholders. The leaders should involve the faculty members, students, and technical experts in decision making.

• Student-Centered Learning

Digital technologies enable personalized and flexible learning experiences. Leaders must prioritize student engagement by supporting interactive and accessible digital learning environments.

Discussion:

This study shows how the model of leadership in higher education is becoming more adaptable and less rigid. In order to successfully implement digital transformations, leaders need to be more adaptive to the quick changes of technologies.

A central topic in the area of digital leadership is the relationship between technology and pedagogics. It is vital for leaders to guarantee that the usage of digital tools improves the quality of teaching without compromising traditional techniques. The process of training faculty members is vital here. Digital equity is another topic which needs to be considered. For example, digital inequality among students should be addressed by leaders to ensure the creation of an inclusive learning environment.

Lastly, the ethical dimension of leadership is important to highlight. Issues of data analysis and artificial intelligence pose a threat when it comes to such factors as privacy and security.

Educational Implications:

This study presents various implications for institutions of higher learning:

- Digital Leadership Training Programs.
- Faculty Professional Development Investment.
- Digital Innovation Policies.
- Student Centered Learning Environments.

Future Directions:

Future research, the main emphasis should be placed on empirical studies of leadership practices in universities conducted with the participation of academic administrators and faculty members. Comparative analysis across various countries will help in obtaining more comprehensive information regarding digital leadership approaches.

Conclusion:

The digitization process in higher learning institutions has redefined the leadership process in these institutions. Leaders must operate in dynamic technological environments while fostering innovation, inclusiveness, and academic excellence.

Digital leadership involves skills such as technological capability, strategizing, collaboration, and flexibility. Organizations adopting these leadership practices thrive in the digital era.

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Digital Device Use and The Need For Digital Detox Among School Students

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Abstract

The increasing integration of digital technology into students' academic, social, and recreational lives has created both opportunities and challenges. Excessive and uncontrolled use of smartphones, computers, tablets, gaming devices, and other digital technologies may interfere with students' concentration, academic activities, physical well-being, and emotional balance. The present study examined digital-device usage patterns and the perceived need for digital detox among school students.

Particular attention was given to frequency of device use, time spent on devices, distraction during study, perceived effects on schoolwork, physical discomfort, emotional restlessness, awareness of excessive digital use, and the role of parents and schools in regulating device use. A descriptive survey design was employed. Data were collected from 100 students using a structured questionnaire and analyzed using percentage analysis.

The findings indicated frequent digital-device use and considerable screen exposure outside school hours. A substantial proportion of students reported distraction during study, perceived effects of device use on schoolwork, physical discomfort after prolonged use, and difficulty in reducing screen time. The findings also revealed gaps in parental and school guidance regarding digital-device use. The study suggests that digital detox should be approached as a process of developing balanced and mindful technology-use habits rather than complete avoidance of technology. Coordinated efforts by students, parents, teachers, and schools are recommended to promote healthy digital behaviour.

Keywords: Digital detox, digital devices, screen time, school students, academic engagement, digital well-being, self-regulation

Introduction:

Digital technology has become an integral part of contemporary education and adolescent life. Smartphones, computers, tablets, online learning platforms, gaming applications, and social media provide students with opportunities for communication, information access, learning, and entertainment. However, the increasing frequency and duration of digital-device use have also raised concerns regarding students' ability to maintain attention, manage their time, engage in physical activities, and participate in face-to-face interactions.

Students in the middle-school years are at an important stage of cognitive, emotional, and social development. During this period, habits concerning technology use and self-regulation are gradually established. Frequent notifications, online entertainment, gaming, and social networking can encourage repeated checking of devices and make it difficult for students to disengage from screens. The dissertation identifies excessive digital use as a concern associated with distraction, reduced concentration, physical discomfort, sleep-related concerns, and emotional dependence.

Digital detox may be understood as a deliberate reduction in unnecessary digital-device use for a specified period. In the context of school students, digital detox should not mean complete rejection of technology because digital tools are also important for education. Rather, it involves developing purposeful use, setting appropriate boundaries, taking regular breaks, and creating opportunities for offline learning, recreation, physical activity, and social interaction.

Previous literature reviewed in the dissertation indicates growing research interest in digital detox, digital minimalism, problematic smartphone use, and the relationship between technology use and well-being. The reviewed studies suggest that structured approaches to reducing unnecessary digital use may support healthier technology habits and well-being.

Need for the Study:

The need for the present study arises from the increasing exposure of school students to digital devices and the possibility that excessive use may interfere with academic engagement and overall well-being. The dissertation particularly emphasizes the importance of developing awareness and self-regulation among students and strengthening the role of parents and schools in promoting balanced digital habits.

Objectives of the Study:

The study was conducted with the following objectives:

1. To examine the digital-device usage patterns of school students.
2. To study students' perceived experiences of distraction and interference with schoolwork associated with digital-device use.
3. To examine the physical and emotional experiences associated with prolonged digital-device use.
4. To assess students' awareness of the negative effects of excessive digital-device use.
5. To examine the extent of parental and school guidance regarding digital-device use.
6. To identify students' perceived difficulty in reducing screen time.

Review of Literature:

Ramadhan, R. N. (2024). Impacts of Digital Social Media Detox for Mental Health. *Journal of Technology in Behavioral Science*. The aim of this study was to provide comprehensive insights into the effects of digital detox interventions on various mental health outcomes. The results indicate that digital detox can lead to improvements in mental health, including reduced stress and enhanced emotional well-being.

Mirbabaie, M., Stieglitz, S., & Marx, J. (2022). Digital Detox. *Business & Information Systems Engineering*. This article discusses the rationale behind digital detox and developments in organizational knowledge work that precipitate the increasing popularity of periodically refraining from the use of IT. The authors propose a conceptualization of digital detox to guide future research in Information Systems and beyond.

Research Methodology

Research Design: A descriptive survey design was adopted to examine students' digital-device usage patterns and their perceptions regarding excessive digital use. A structured questionnaire was used as the primary research instrument.

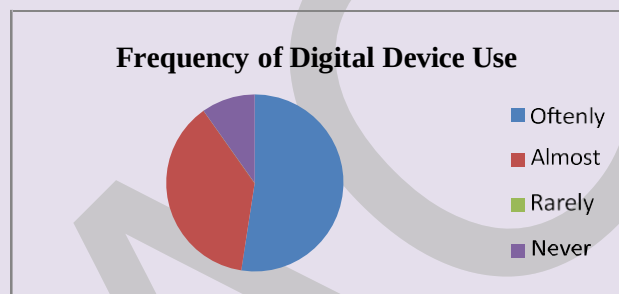
Sample: A total sample of 100 students were selected through convenience sampling from Hyderabad secondary schools.

Statistical Methods: Primary data were collected using a structured questionnaire. The study used percentage analysis to summarize responses.

Data Analysis and Interpretation:

Frequency of Digital-Device Use:

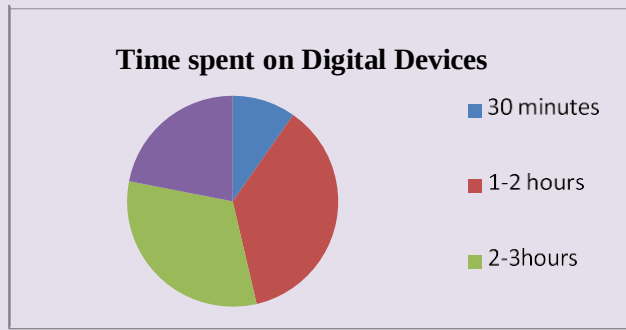
The findings indicate frequent use of digital devices among respondents. 32% reported using digital devices often during a typical school day, while 23% reported using them almost constantly. In contrast, only 6% reported almost never using digital devices. This indicates that digital devices are a regular part of students' daily lives.



Time Spent on Digital Devices

After school, 30% of students reported spending 1–2 hours on digital devices and 26% reported spending 2–3 hours. A further 18% reported spending more than three hours, while only 8% reported spending less than 30 minutes.

Thus, 74% of the respondents reported spending at least one hour on digital devices after school, suggesting considerable exposure to screens beyond formal classroom requirements.



Digital Distraction During Study

Digital-device use was also associated with reported distractions during study. 29% sometimes and 24% often checked notifications or messages while studying, while 16% reported always doing so. This suggests that notifications and digital interruptions may make sustained concentration difficult for some students.

Similarly, 30% frequently and 16% almost always experienced distraction from digital devices while trying to concentrate on school tasks. These findings indicate a perceived association between device use and difficulties in maintaining academic attention.

Perceived Effect on Schoolwork

Regarding the effect of device use on schoolwork, 35% reported that it affected their schoolwork somewhat, 19% quite a bit, and 13% a great deal. Therefore, more than half of the respondents perceived at least some interference with their schoolwork.

Awareness of Negative Effects

Students demonstrated varying levels of awareness regarding the negative effects of excessive digital use. 33% were moderately aware, while 29% were very aware and 11% extremely aware. Nevertheless, 27% were either slightly aware or not aware at all.

Physical and Emotional Experiences

Physical discomfort following prolonged digital-device use was reported by a considerable proportion of students. 32% sometimes and 23% often experienced physical discomfort, while 9% experienced it always.

Emotional restlessness was also reported when devices were unavailable. 28% sometimes, 17% frequently, and 10% always experienced restlessness or anxiety in such situations. These responses suggest that some students may experience difficulty disengaging from their devices, although the study does not establish clinical digital addiction or anxiety.

Parental and School Guidance

Parental guidance regarding screen-time limits appeared inconsistent. While 21% of students reported that parents often discussed device limits and 11% reported that this happened always, 41% reported that such discussions occurred rarely or never.

School guidance was similarly variable. 28% reported receiving guidance sometimes, whereas 25% received it frequently or always. However, 22% reported receiving no school guidance regarding digital-device use.

Difficulty in Reducing Screen Time

An important finding concerns students' ability to regulate their own screen use. 26% found it difficult and 18% very difficult to stick to a plan to reduce screen time. In contrast, 21% found it easy and 13% very easy.

Thus, 44% of respondents reported difficulty reducing screen time, suggesting that awareness of excessive use may not automatically translate into effective self-regulation.

Conclusion:

The study provides evidence of substantial digital-device engagement among the surveyed school students. Many respondents reported frequent device use, extended screen exposure after school, distractions during study, perceived interference with schoolwork, physical discomfort, and difficulty reducing screen time.

The findings also reveal gaps in parental and school guidance. While some students receive support in managing digital use, a considerable proportion reported limited or no guidance. This indicates the need for a coordinated approach involving students, parents, teachers, and school authorities.

The findings support the view that digital detox should be understood as balanced and mindful technology use rather than complete abstinence. Students need opportunities to

develop self-regulation, time-management skills, and awareness of the difference between productive and recreational digital use.

Educational Implications

- Schools can conduct digital-wellness awareness programmes for students.
- Teachers can encourage appropriate screen breaks and device-free learning periods where feasible.
- Parents can establish consistent and realistic home screen-use routines.
- Students can be taught self-monitoring and time-management strategies.
- Schools can encourage sports, reading, creative activities, and face-to-face social interaction as alternatives to recreational screen use.

Limitations

- The sample was selected through convenience sampling; therefore, generalization is limited.
- The study relied mainly on self-reported responses, which may be affected by recall or response bias.
- The study was conducted within a limited geographical area.
- The study did not employ inferential statistics to test relationships between variables.

Suggestions for Further Research:

- Use a larger and more representative sample.
- Compare students across different school grades and age groups.
- Examine gender- and grade-wise differences in digital-device use.
- Use correlation or regression analysis to examine associations between screen time and academic outcomes.

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From Visualisation to Competence Modelling: Rethinking Academic Standards in Telangana State Board Science Education

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Abstract

Science education is increasingly expected to move beyond the transmission and representation of scientific knowledge towards the development of competencies that enable learners to question, investigate, interpret evidence, construct explanations and apply scientific understanding in unfamiliar situations. In the context of Telangana State Board science education, visualisation through diagrams, demonstrations, illustrations and representations remains an important component of classroom learning. However, visualisation alone may not adequately capture the broader range of scientific practices and competencies expected of contemporary learners.

This paper critically examines the position of visualisation within science education and proposes a shift towards a broader competence-oriented approach, referred to in this paper as competence modelling. Competence modelling is conceptualised as the explicit modelling and development of the cognitive, procedural and reflective processes involved in scientific inquiry. The paper is based on a structured review and comparative analysis of relevant curriculum documents, policy perspectives and literature concerning science education, scientific inquiry, competency-based education and classroom practice. The analysis suggests that visualisation should not be eliminated but repositioned as one component within a wider framework of scientific competence.

The paper argues that Telangana State Board science education can be strengthened by making scientific processes—such as questioning, observation, experimentation, evidence-based reasoning, explanation, application and reflection—more visible in teaching, learning and assessment. Such a shift would be consistent with broader competency-oriented directions in contemporary Indian education while retaining the pedagogical value of visual and representational approaches.

Keywords: Science Education, Telangana State Board, Visualisation, Competence Modelling, Scientific Inquiry, Competency-Based Education, Academic Standards, Science Pedagogy

Introduction:

Science education is not limited to the acquisition of scientific facts, definitions and principles. It also involves developing the capacity to observe phenomena, formulate questions, investigate problems, interpret evidence, construct explanations and apply knowledge to new situations. Consequently, contemporary science education increasingly emphasises not only what students know, but also what students can do with what they know.

Visualisation occupies an important position in science learning. Diagrams, models, demonstrations, illustrations, animations and other visual representations can make abstract scientific concepts more accessible to learners. Visualisation can support conceptual understanding by enabling students to represent processes and relationships that may not be directly observable. It therefore remains an important pedagogical resource in school science.

However, visualisation becomes insufficient when it functions primarily as the endpoint of learning. Students may be able to reproduce a diagram, identify parts of a scientific apparatus or recall a visually presented concept without necessarily being able to formulate a question, design an investigation, interpret evidence or apply the concept to a new context.

The issue, therefore, is not whether visualisation should be removed from science education. Rather, the question is how visualisation can be repositioned within a broader conception of scientific competence.

This question is particularly relevant to Telangana State Board science education. Official SCERT Telangana science materials explicitly describe science learning in terms of questioning, observation, experimentation, projects, information collection, analysis and drawing conclusions. The Class VII General Science textbook, for example, describes science as involving questioning, observing nature, experimentation and systematic understanding. It also states that science learning includes projects, observations, experiments, information collection, analysis and the development of conclusions and generalisations. (SCERT Telangana)

Thus, the challenge is not necessarily the absence of inquiry-oriented elements in the curriculum. Instead, the challenge is how these elements can be made sufficiently visible and systematic in classroom pedagogy and assessment.

This paper proposes competence modelling as a conceptual framework through which teachers can explicitly demonstrate and develop the processes involved in scientific thinking. Rather than replacing visualisation, competence modelling places visualisation within a larger sequence of scientific activity:

observe → question → represent → investigate → interpret → explain → apply → reflect.

Conceptualising Academic Standards in Science Education

Academic standards in science education should reflect more than the ability to reproduce information. They should represent the knowledge, skills, processes and dispositions that students are expected to develop through science learning.

The Telangana State Board's science materials themselves provide evidence of a broader understanding of academic standards. SCERT Telangana describes science learning as involving projects, observations, experiments, collection and analysis of information, conclusions and generalisations. (SCERT Telangana)

Similarly, Telangana science textbooks emphasise observation, research enthusiasm and scientific thinking. The Class X Biology textbook states that the new science textbooks are intended to develop students' observation power and research enthusiasm and encourages teachers to move beyond examination-oriented practices. (SCERT Telangana)

Therefore, it would be inaccurate to characterise Telangana science education as being exclusively based on visualisation. A more appropriate interpretation is that visual and representational practices form one important part of science learning, while the curriculum also provides a basis for inquiry, experimentation and scientific reasoning.

The academic challenge is to strengthen the connection between these elements so that students are not merely shown scientific phenomena but are supported in thinking scientifically about those phenomena.

From Visualisation to Competence

Visualisation as a Foundation for Science Learning

Visualisation can perform several important functions in science education. It can:

- simplify complex concepts;
- represent microscopic or abstract phenomena;
- demonstrate relationships between variables;
- support memory and conceptual organisation;
- facilitate communication of scientific ideas; and
- provide learners with representations that support further reasoning.

For example, diagrams of the human circulatory system, models of the solar system, illustrations of cellular structures and representations of physical processes can provide important foundations for conceptual understanding.

Consequently, the purpose of this paper is not to reject visualisation. Instead, visualisation should be understood as a means through which learners begin to observe, represent and reason about scientific phenomena.

Limitations of Visualisation as an Endpoint

Problems arise when students' engagement with visual representations remains primarily reproductive. A student may accurately reproduce a labelled diagram but still struggle to explain why a process occurs, predict what might happen if a variable changes, interpret experimental evidence or apply the concept to an unfamiliar situation.

This creates a distinction between:

Representation of knowledge and demonstration of competence.

Representation answers questions such as:

- What does the concept look like?
- Can the learner identify the parts?
- Can the learner reproduce the diagram?

Competence-oriented learning asks additional questions:

- Can the learner explain the concept?
- Can the learner formulate a relevant question?
- Can the learner design or describe an investigation?
- Can the learner interpret evidence?
- Can the learner justify a conclusion?
- Can the learner apply the concept to a new situation?

The second set of questions provides a broader understanding of academic achievement in science.

Competence Modelling in Science Education

For the purposes of this paper, competence modelling refers to the deliberate and explicit modelling of the processes through which scientific competencies are developed and demonstrated.

It involves teachers making scientific thinking visible to students rather than presenting scientific knowledge only as finished information.

A competence-oriented science lesson may therefore involve the teacher modelling how to:

1. observe a phenomenon carefully;
2. identify an interesting or problematic feature;
3. formulate a scientific question;
4. propose a possible explanation or prediction;
5. determine what evidence is needed;
6. plan or conduct an investigation;
7. record and organise observations;
8. interpret evidence;
9. construct an explanation;
10. communicate the conclusion; and
11. reflect on whether the evidence supports the explanation.

In this framework, visualisation remains important. A diagram, model or demonstration can initiate the process, but students should move beyond observing the representation towards questioning, investigating, reasoning and applying.

Thus:

**Visualisation → Questioning → Investigation → Evidence → Explanation →
Application → Reflection**

can provide a useful pedagogical sequence for competence-oriented science education.

Telangana State Board Science Education: Scope for a Competence-Oriented Approach

The official SCERT Telangana science curriculum and textbooks already contain several elements that support inquiry-oriented science learning. The Class VII General Science textbook explicitly discusses children's curiosity, questioning, observation, experimentation and systematic scientific understanding. (SCERT Telangana)

The same textbook explains that science learning includes projects, observations, experiments, information collection, analysis and arriving at conclusions and generalisations. (SCERT Telangana)

Similarly, Telangana science textbooks emphasise scientific thinking, observation and research enthusiasm and caution against reducing classroom teaching to examination preparation. (SCERT Telangana)

These elements suggest that the proposed shift does not require the Telangana curriculum to abandon its existing foundations. Instead, the existing inquiry-oriented components can be made more systematic through classroom practice and assessment.

The present paper therefore interprets competence modelling as a developmental extension and pedagogical strengthening of existing science-education principles rather than as a complete replacement of the current curriculum.

Competency-Based Education and the Broader Indian Context:

The movement towards competency-based education has become increasingly important within Indian educational policy. Competency-based approaches emphasise clearly

articulated knowledge, skills and dispositions and seek to connect teaching and assessment with the competencies students are expected to develop.

Policy implementation work following the National Education Policy (NEP) 2020 has included competency-based learning frameworks in school subjects, including science. These frameworks are intended to make competencies explicit and support teachers and learners in tracking learning levels and improving assessment.

This broader movement strengthens the relevance of reconsidering how academic standards are conceptualised in school science.

However, competency-based education should not be reduced to a change in examination questions alone. If assessment is expected to measure scientific competencies, classroom instruction must also provide students with opportunities to practise those competencies.

For science education, this means giving students repeated opportunities to:

- ask scientific questions;
- observe systematically;
- conduct investigations;
- analyse evidence;
- construct explanations;
- communicate findings;
- solve scientific problems; and
- transfer knowledge to new contexts.

International Perspective: Working Scientifically:

An important international comparison is provided by curriculum approaches that explicitly identify scientific practices as part of science learning. The concept of “working scientifically” illustrates an approach in which students are expected not only to acquire scientific knowledge but also to develop the practices involved in scientific investigation and reasoning.

Such approaches demonstrate that scientific processes can be made explicit within curriculum expectations and assessment.

The relevance for Telangana is not to reproduce another country's curriculum mechanically. Rather, the international experience demonstrates the value of explicitly identifying the processes through which scientific knowledge is constructed, evaluated and communicated.

This perspective supports the argument that academic standards in science can include both conceptual knowledge and scientific practice.

Proposed Framework for Competence-Oriented Science Teaching:

Based on the discussion above, this paper proposes a framework with seven interconnected dimensions:

- **Observation**

Students observe phenomena, objects, processes, diagrams, models or demonstrations carefully and identify significant features.

- **Questioning**

Students formulate questions that can be investigated scientifically.

- **Investigation**

Students participate in experiments, projects, demonstrations, field observations or other appropriate investigative activities.

- **Evidence and Interpretation**

Students collect, organise and interpret information rather than simply record observations.

- **Explanation**

Students use evidence and scientific concepts to construct and justify explanations.

- **Application**

Students apply their understanding to unfamiliar situations, everyday problems or new scientific contexts.

- **Reflection and Communication**

Students communicate findings, evaluate their reasoning and reflect on the adequacy of their explanations.

Visualisation can support every stage of this framework. For example, diagrams may help observation and explanation, graphs may support interpretation, models may support prediction, and visual representations may assist communication.

Therefore, the framework does not place visualisation and competence in opposition. Instead, it integrates visualisation within the broader development of scientific competence.

Educational Implications:

- Teachers should move from simply demonstrating scientific procedures towards modelling the reasoning behind those procedures. Instead of only showing students how an experiment is performed, teachers can explain why a particular variable is controlled, why a measurement is necessary and how evidence contributes to a conclusion.
- Teachers can make their own scientific thinking explicit. For example:
- “I observe this change. What might explain it? What evidence would help us distinguish between the possible explanations?”
- A competence-oriented approach requires corresponding changes in assessment.
- Traditional assessment may place substantial emphasis on whether students can recall definitions, identify diagrams or reproduce explanations. These forms of assessment remain useful for checking foundational knowledge, but they should be complemented by tasks that assess scientific processes.

Discussion:

The central argument of this paper is that visualisation remains pedagogically valuable but should not be treated as a sufficient indicator of scientific competence.

The evidence reviewed suggests that Telangana's science curriculum already recognises several dimensions of scientific inquiry. Official SCERT materials refer to questioning,

observation, experimentation, projects, information collection, analysis, conclusions and generalisations. (SCERT Telangana) The curriculum materials also emphasise observation, research enthusiasm and scientific thinking and caution against examination-oriented teaching. (SCERT Telangana)

Therefore, the proposed reform is not necessarily a radical replacement of existing curricular principles. Instead, it is a call to strengthen their implementation.

The concept of competence modelling provides one possible way of achieving this. By explicitly modelling scientific thinking, teachers can help students understand that science is not simply a collection of correct answers but a process involving questions, evidence, reasoning and explanation.

This approach also responds to broader competency-oriented developments in Indian education. Competency-based learning frameworks seek to make knowledge, skills and dispositions explicit and to improve the alignment between teaching and assessment.

The most appropriate interpretation, therefore, is not:

Visualisation versus competence modelling

But:

Visualisation within competence modelling.

A diagram can be the starting point for a question. A demonstration can lead to an investigation. A model can generate a prediction. A graph can provide evidence for an explanation. In this way, visualisation becomes an important tool within a larger scientific learning process.

Challenges in Implementation:

- Examination Pressure: Teachers may continue to prioritise examination preparation when assessment systems reward recall more strongly than scientific reasoning.
- Teacher Preparation: Teachers require professional development in inquiry-based teaching, formative assessment, scientific reasoning and competency-oriented lesson planning.

- **Time Constraints:** Investigations and project-based activities may require more classroom time than direct instruction.
- **Resource Constraints:** Some schools may have limited access to laboratories, materials or digital resources. However, competence-oriented teaching does not necessarily require sophisticated equipment. Everyday materials, local environments and simple observations can support meaningful scientific inquiry.
- **Assessment Alignment:** Teachers may find it difficult to assess competencies consistently unless assessment guidelines and examples are clearly provided.

Recommendations

- Retain visualisation as an important component of science pedagogy, but avoid treating it as the endpoint of learning.
- Make scientific processes explicit in classroom teaching by modelling questioning, investigation, evidence interpretation and explanation.
- Develop competence-oriented assessment tasks that require students to apply knowledge rather than reproduce information alone.
- Strengthen teacher professional development in scientific inquiry, modelling, formative assessment and competency-based pedagogy.
- Integrate local contexts and everyday problems into science learning to support application and transfer.
- Provide structured inquiry opportunities through experiments, projects, field observations and investigations.
- Develop clear competency descriptors so that teachers and students understand what successful scientific performance looks like.
- Align curriculum, pedagogy and assessment so that the competencies expected by the curriculum are also taught and assessed.
- Use visual representations strategically, connecting diagrams and models to questioning, prediction, investigation and explanation.
- Undertake classroom-based research in Telangana to examine how competence-oriented approaches influence students' scientific reasoning, engagement and achievement.

Limitations:

This paper is conceptual and analytical in nature and does not report primary empirical data collected directly from Telangana State Board classrooms.

The argument is based on the analysis of relevant curriculum materials, policy perspectives and literature. Consequently, the paper cannot establish the actual frequency with which teachers use visualisation, inquiry or competence-oriented practices in Telangana classrooms.

Future research should therefore include classroom observations, teacher interviews, student assessments and intervention studies to examine the relationship between pedagogical practices and students' development of scientific competencies.

In addition, the concept of competence modelling proposed in this paper requires further empirical validation and refinement before it can be treated as a fully established pedagogical model.

Conclusion:

Science education needs to prepare learners not only to remember scientific knowledge but also to use that knowledge for questioning, investigation, reasoning, explanation and problem solving.

Visualisation remains an important part of this process. Diagrams, demonstrations, models and other visual representations can support students' understanding of complex scientific ideas. However, visualisation alone does not fully represent scientific competence.

The evidence reviewed in this paper suggests that Telangana's science curriculum already contains important foundations for inquiry-oriented learning, including questioning, observation, experimentation, projects, analysis and the development of conclusions. (SCERT Telangana) The challenge is therefore to strengthen and systematically integrate these elements into everyday teaching and assessment.

Competence modelling provides one possible framework for this purpose. It places scientific thinking at the centre of classroom practice and encourages teachers to make the processes of observation, questioning, investigation, evidence-based reasoning, explanation, application and reflection visible to learners.

The proposed shift should therefore not be understood as a rejection of visualisation. Rather, visualisation should be repositioned from an endpoint of learning to a tool within a broader competence-oriented approach.

The future direction of science education in Telangana can consequently be understood not as a movement from visualisation to the abandonment of visualisation, but as a movement from representation alone towards representation integrated with scientific competence.

Such an approach has the potential to make academic standards in science more closely aligned with the capabilities learners need to engage meaningfully with scientific knowledge, inquiry and real-world problems.

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