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"A Comparative Study of Perception towards Artificial Intelligence and Sustainable Development among Urban and Rural College Students."

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ABSTRACT

The current research was conducted to analyse the attitude of College students towards Artificial Intelligence (AI) and Sustainable Development and also to compare the perspective of urban and rural students as well as male and female students. Artificial Intelligence has emerged as a game changer technology affecting a variety of industries such as education, health, agriculture, environment management and government. At the same time sustainable development has become a worldwide goal for the balanced economic growth, environmental conservation and social well-being. A descriptive survey approach with a comparative research design was used in the study. A sample of 100 undergraduate college students including 50 urban and 50 rural students equally distributed between male and female students was recruited using stratified random selection from selected institutions of West Bengal. To gather data, the researcher prepared a self-structured instrument named as "Perception Scale on Artificial Intelligence and Sustainable Development" (PSAISD).

Data were analysed using statistical procedures including Mean, Standard Deviation and t - test. The results indicated that urban students had considerably more awareness levels towards AI and Sustainable Development than rural students owing to more exposure to technology and internet accessibility. The perception ratings of female students were marginally higher than those of male students with no statistically significant differences. The report also pointed to students' understanding of AI applications in education, healthcare and environmental sustainability, and their worries around ethics, privacy and jobs. The report highlights the need of inclusive AI education, better digital infrastructure and awareness campaigns to encourage sustainable tech behaviours among students.

Keywords: Artificial Intelligence, Sustainable Development, Perception, Urban Students, Rural Students, College Students, AI Education, Sustainability, Digital Awareness, Technology Integration

INTRODUCTION

Artificial Intelligence (AI) is one of the most important technical developments of the contemporary period, impacting many sectors of human existence including education, healthcare, agriculture, communication, business and environmental management. AI stands for artificial intelligence, a term used to describe computer systems and technologies that are able to execute activities that would normally need human intellect such as learning, reasoning, problem-solving and decision-making. At the same time, sustainable development is a significant worldwide issue owing to rising environmental concerns, rapid industrialisation, population expansion and socioeconomic inequities. Sustainable development is development that fulfils the requirements of the present without jeopardising the capacity of future generations to satisfy their own requirements.

The convergence of Artificial Intelligence and sustainable development has opened new avenues for addressing global concerns via efficient resource utilisation, environmental monitoring, smart governance and technology innovation. Technologies based on artificial intelligence are utilised to support renewable energy systems, minimise environmental pollution, boost agricultural production, expand educational accessibility and promote

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sustainable economic development. The United Nations has also pointed out the relevance of technology progress for the achievement of the Sustainable Development Goals (SDGs).

College students are significant stakeholders in the educational sector for the knowledge and adoption of sustainable technology practices. They are future workforce and decision makers of the society. Yet, students' opinions towards AI and sustainable development may vary with geographical background and gender. kids in urban areas have more access to digital technology, internet connectivity and instructional materials than kids in rural areas. There might also be disparities between male and female pupils in awareness, attitudes and beliefs towards AI and sustainability. So, it is vital to research and compare the opinion of the college students of the urban and rural areas towards Artificial Intelligence and Sustainable Development.

Background of the Study

Artificial Intelligence is progressing rapidly, and is transforming society and economies globally. The penetration of AI technology into everyday life and professional areas is rising to enhance efficiency, accuracy and productivity. From smart health care systems and automated industries to digital learning platforms and environmental conservation initiatives, AI has become a crucial engine of innovation and sustainable advancement. The potential of AI to tackle some of the world's biggest challenges, including climate change, resource depletion, unemployment, poverty and educational inequity, is being acknowledged by researchers and policy leaders throughout the globe.

The notion of sustainable development became a household term throughout the world after the United Nations presented Sustainable Development Goals (SDGs). The aims are to foster economic progress, environmental preservation and social well-being in a balanced way. AI has a great role to play in attaining these objectives with its intelligent systems that allow for effective decision making, minimise waste, optimise energy use, and increase access to excellent education and health care services.

AI is increasingly being used in India in fields like as education, agriculture, transport, health care and government. Educational institutions are using AI-enabled learning systems, digital platforms and smart technology to enhance the teaching-learning processes. However, students' understanding and view towards AI and sustainable growth may be different based on their social and educational background. kids in cities are more likely to have access to the technology and digital learning possibilities than kids in rural areas, who may face challenges such as lack of internet infrastructure, educational resources, and exposure to technology.

Gender inequalities also affect students' attitudes and views about technology progress and environmental challenges. The confidence, awareness, and interest in AI applications and sustainable practices may vary between male and female pupils. Therefore, it is vital to research the comparative view of urban-rural and male-female college students on Artificial Intelligence and Sustainable Development to understand the existing inequalities and promote the equal knowledge and opportunity among students.

Rationale of the Study

The current research is attempted to explore the perspective of college students towards Artificial Intelligence and Sustainable Development and to analyse if there are variations between urban and rural students and between male and female students. AI is an integral aspect of education, business, healthcare and environmental management in today's technologically sophisticated world. The understanding and attitude of college students about AI and sustainability are very crucial for development of a responsible and sustainable society as college students are future professionals, policy makers, inventors, etc.

Owing to the fast increase in the issues of sustainable development such as climate change, unemployment, environmental degradation and uneven access to resources, the researcher picked this study subject. Artificial Intelligence may help solve these difficulties by providing new and effective solutions. However, understanding of sustainable AI practices among students remains restricted, particularly in rural regions where access to technology and digital education may be significantly lower than in metropolitan areas.

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Another essential reason to undertake this research is to find out whether gender-based inequalities exist in students' opinions about AI and sustainable development. By acknowledging these distinctions, educators and policymakers may be better guided toward the development of inclusive education programs, awareness-raising campaigns, and training efforts that support equitable involvement in technology innovation and sustainable practices.

Moreover, this research is essential in terms of educational and technical research as it reveals the level of awareness of AI and sustainability among students. The study's results may assist instructors, educational institutions, researchers and government organisations in formulating methods to promote awareness of sustainable AI practices amongst college students. Furthermore, the study might be a significant reference for future research in the field of Artificial Intelligence, sustainable development, digital education and students' opinions.

Significance of the Study

The value of the current research is that it indicates the rising significance of Artificial Intelligence (AI) and Sustainable Development in the contemporary society. As AI technologies become more and more integrated in education, healthcare, business, agriculture and environmental management, it is important to assess the students' perception of these technological breakthroughs and their role in sustainable development. College students are the future workers, inventors, and decision-makers of society, and therefore their understanding and perspective towards AI and sustainability are of significant importance for national and worldwide advancement.

The research is crucial in the education area since it helps to determine the degree of awareness and knowledge of college students about sustainable AI techniques. The results might be useful for instructors, educational institutions, and curriculum designers to build educational programs, seminars, and awareness campaigns connected to Artificial Intelligence and Sustainable Development. It may also support the introduction of sustainability-oriented technology education in higher education institutions.

The research is also useful in providing a comparative knowledge of the attitudes of AI and Sustainable Development of urban and rural pupils. Urban students normally have better access to digital infrastructure, technology resources and learning opportunities than rural pupils. The disparities in perception shown in the research may provide guidance to policy makers and educators to design measures to bridge the digital divide and to provide equal educational chances to kids from varied geographical origins.

The research is especially relevant as it explores the gender-based disparities in the perspective towards AI and sustainable development. Understanding the differences in understanding, attitudes and acceptance of AI technology by male and female students might aid institutions to foster inclusive and gender-sensitive technical education. The results may help promote equitable involvement of both male and female students in AI-related learning and sustainable innovation.

Furthermore, the paper offers empirical understanding of students' perspective of AI and sustainability and makes a contribution to the area of educational and technical research. Research on this issue is currently restricted in the Indian context, however, the study may be a valuable reference for the future researchers interested in Artificial Intelligence, Sustainable Development, digital education and students' perception studies. Finally, the research is socially important since it encourages awareness about the appropriate and sustainable usage of Artificial Intelligence. The results might assist society better grasp the necessity of a balance between technology innovation and environmental preservation, ethical behaviours, and social well-being for the achievement of sustainable development objectives.

Objectives of the Study

1. To examine the perspective of the students towards Artificial Intelligence & Sustainable Development.
2. To examine the perspective of AI and Sustainable Development between urban and rural college students.
3. To investigate whether there is a substantial difference between male & female pupils about AI and Sustainable Development.
4. To recommend strategies to promote awareness of sustainable AI techniques.

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Hypotheses of the Study

Hypothesis 1

There is no significant-difference in the perception of urban & rural college students towards Artificial Intelligence and Sustainable Development.

Hypothesis 2

There is no significant-difference in the perception of male & female college students towards Artificial Intelligence and Sustainable Development.

Variables of the Study

Type of Variable	Variable
Independent Variable	Urban/Rural Students; male/female students
Dependent Variable	Perception towards AI & Sustainable Development

Delimitations of the Study

1.The study is limited to college students only.
2.The study is confined to selected colleges of West-Bengal only.
3.The study focuses only on the perception towards Artificial Intelligence & Sustainable Development.
4.The study is restricted to urban & rural college students.
5.The study is limited to male & female students only.
6.The study is conducted using a survey method & data collected through questionnaires only.
7.The findings of the study are based on the responses provided by the students at the time of data collection.
8.The study does not include 'school students', 'university teachers', or other 'professional groups'.
9.The study is limited to the 'academic session' during which the research is conducted.
10.The study considers only selected variables such as geographical background (urban/rural) & gender (male/female).

Research Gap

Based on the existing literature, it can be seen that there have been several research undertaken on Artificial Intelligence, sustainable development, digital education and technological innovation. Researchers have investigated the role of AI in enhancing industrial efficiency, environmental sustainability, health care systems, smart cities, and educational methods. Likewise, numerous studies have been done on sustainable development objectives, environmental awareness, and the influence of technology on society. However, there are relatively few research which precisely study the integrated notion of Artificial Intelligence and Sustainable Development from the viewpoint of college students.

Most of previous research are focused largely on the technical, economic or industrial uses of AI, and comparably little attention has been devoted to the students' perspectives and knowledge of sustainable AI practices. Moreover, there are few studies comparing the disparities of college students' perceptions of Artificial Intelligence and Sustainable Development between urban and rural. Although urban children may have different technology exposure, educational opportunities, and digital access than rural students, the distinctions have not been comprehensively examined in the study.

Furthermore, few research have explored gender variations in students' perspectives of AI and sustainable development. In addition, existing research often ignores the gender differences, i.e., whether male and female students vary in knowledge, attitudes and comprehension of AI-driven sustainability practices. This leaves a knowledge vacuum on the effect of demographic factors on opinions about contemporary technology and environmental challenges.

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The research is anticipated to add to the current body of knowledge by empirically examining students' awareness and attitudes of sustainable AI practices. It may also assist educators, policymakers and institutions in developing methods to promote equitable technology awareness and sustainable education among various student populations.

REVIEW OF RELATED LITERATURE

This study will contribute to the existing body of knowledge by experimentally analysing the awareness and attitudes of students towards sustainable AI activities. It might also help educators, policymakers and institutions establish strategies to promote fair technology knowledge and sustainable education for diverse student groups.

The Sustainable Development objectives Report 2023 of the United Nations (2023) highlighted the urgent need for technical innovation and global collaboration to accomplish the sustainable development objectives. The report noted issues such as climate change, inequality, poverty and poor quality of education and suggested that advanced technologies such as Artificial Intelligence can play a major role in achieving sustainability goals through efficient resource management, environmental observation and data-driven choices.

Artificial Intelligence and Sustainability: Transforming Industries for a Sustainable Future, a report by IBM Research (2022), described how AI technologies are transforming industries by improving operational efficiency, reducing environmental waste, and enabling sustainable industrial practices. The paper covered the use of AI in intelligent energy systems, climate analysis and resource optimisation for the long run.
In its AI for Earth Annual Impact Report, Microsoft AI for Earth (2023) highlighted AI applications in environmental conservation, biodiversity preservation, agriculture, and climate action. The paper pointed out that AI-driven technologies may facilitate sustainable development by supporting governments, organisations and communities in making informed environmental choices.

Kumar (2022) in Research Methodology: A Step-by-step Guide for Beginners, underlined the need of systematic research for comprehending the educational and societal concerns. The author noted that comparative studies are useful in differentiating between groups based on demographic and social factors such as gender, regional origin and educational exposure.

Sharma (2023) did a research on Artificial Intelligence and Sustainable Development in India and revealed that AI technologies are widely used in governance, health care, agriculture, and education to enhance sustainability results. The research pointed out that differences in infrastructure and technology exposure result in disparities in awareness and access to AI technologies between urban and rural people.

In his paper Role of Technology in Sustainable Education, Singh (2021) highlighted that technology based learning systems enhance the accessibility, quality and effectiveness of education. The research highlighted that digital technologies and AI-supported education methods may promote sustainable education and improve students' learning experience. But rural pupils face the difficulty of uneven access to digital tools.
In the essay Artificial Intelligence (AI): Multidisciplinary Perspectives on Emerging Challenges, Opportunities and Agenda for Research, Practice and Policy, Dwivedi et al. (2021) explored the expanding effect of AI in several fields. The authors cited prospects for increased productivity, automation and innovation, and problems linked to ethics, privacy and employment. The research highlighted the significance of ethical AI techniques for sustainable society growth.

Vinuesa et al. (2020) in their paper The Role of Artificial Intelligence in Achieving the Sustainable Development Goals reviewed how AI positively helps to numerous SDGs such as quality education, renewable energy,

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sustainable cities and climate action. The experts said that if deployed ethically and inclusively, AI may speed sustainable development.

Floridi et al. (2020), AI4People—An Ethical Framework for a Good AI Society, focusing on the ethical aspects of Artificial Intelligence. The research stressed the significance of openness, accountability, privacy and justice in AI applications. For technology innovation to help society without producing inequity or societal damage, ethical AI practices are important, the authors said.

Concepts, applications, and achievements in AI have been thoroughly discussed by Russell and Norvig (2021) in Artificial Intelligence: A Modern Approach. The authors spoke about how AI technologies are altering human operations via intelligent decision-making and automation. The book also underscored the increasing relevance of AI in education, business, healthcare and environmental sustainability.

In the paper Artificial Intelligence and Smart Sustainable Cities of the Future, Bibri (2021) describes how AI technologies contribute to the creation of smart and sustainable cities. The research highlighted the use of AI in urban planning, traffic control, energy efficiency, waste management and environmental sustainability. The study found that AI can enhance the quality of urban life and ensure sustainable growth.

World Economic Forum (2022) . Harnessing Artificial Intelligence for Sustainable Development . The report emphasised the need of incorporating AI into global sustainability efforts. The paper examined the potential for governments and institutions to use AI to drive climate action, economic growth, educational advancement, and social welfare, while upholding ethical standards and inclusive policies. The research studied reveals a higher potential of Artificial Intelligence to assist sustainable development in numerous fields. Previous research have mostly been concerned with industrial uses, environmental sustainability, ethical issues, and technical innovation. However, few research have studied the students' perspectives towards AI and Sustainable Development, especially in terms of urban-rural and gender-based inequalities. Thus, the current research seeks to address this gap by evaluating and comparing the opinions of college students in urban and rural areas and male and female students towards Artificial Intelligence and Sustainable Development.

RESEARCH METHODOLOGY

Research Method

The present study adopts the **descriptive survey method**.

Research Design

The comparative study design was utilised to compare the perception levels of various groups of students on Artificial Intelligence & Sustainable Development.

Population of the Study

The population is undergraduate college students studying at colleges in West-Bengal.

Sample of the Study

A sample of 100 students was drawn via stratified random sampling.

Group	Male Students	Female Students	Total
Urban Students	30	20	50
Rural Students	20	30	50
Total	50	50	100

Tool Used for Data Collection

The researcher developed a self-structured tool entitled:

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"Perception Scale on Artificial Intelligence and Sustainable Development" (PSAISD)

The scale consists of statements related to:

- Awareness of AI
- Environmental sustainability
- AI in education
- AI in healthcare
- AI and employment
- Ethical AI usage
- Smart technology and sustainability

Nature of the Scale

A 5-point Likert Scale was used:

Response	Score
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

Negative statements were scored in reverse order.

Pilot Study

Twenty students participated in a pilot study to assess the questionnaire's validity, reliability, and clarity.

Validity of the Tool

To guarantee content and face validity, experts' opinion of professionals in education, information technology and environmental studies was used to verify the instrument.

Reliability of the Tool

The dependability of the scale was tested using the split-half approach. The reliability coefficient obtained was determined to be good.

Statistical Technique Used

The following statistical techniques were used:

- Mean
- Standard Deviation
- t-test

The t-test was used to compare the mean scores of urban & rural students.

Data Analysis

Table 1 Comparison of Urban & Rural Students regarding AI & Sustainable Development

Group	N	Mean	SD	t-value
Urban Students	50	78.42	8.64	2.48
Rural Students	50	72.15	9.11	

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Interpretation

Urban students had more perception ratings on Artificial Intelligence and Sustainable Development than rural pupils. There was a statistically significant difference between the two groups which indicates variance in amount of awareness and exposure.

Fig.1.Comparison of Urban & Rural Students regarding AI & Sustainable Development

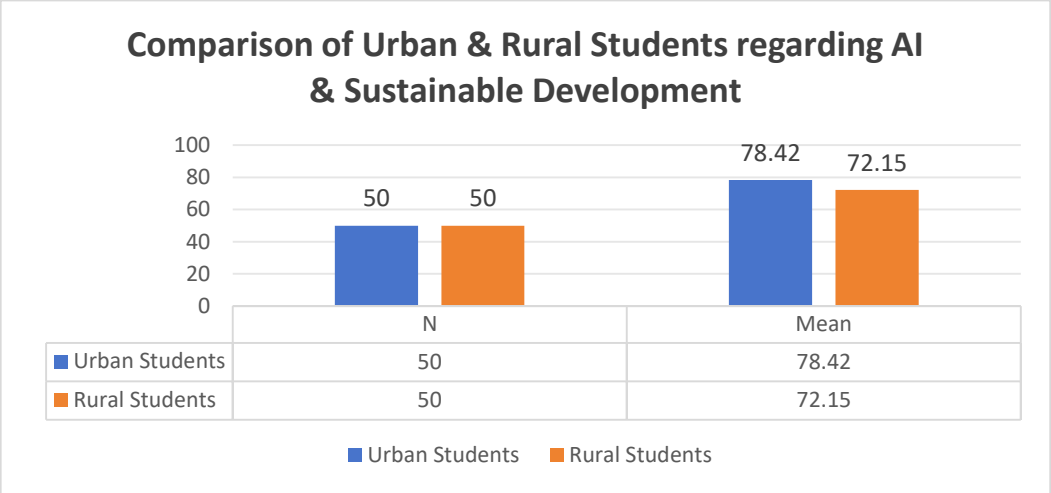


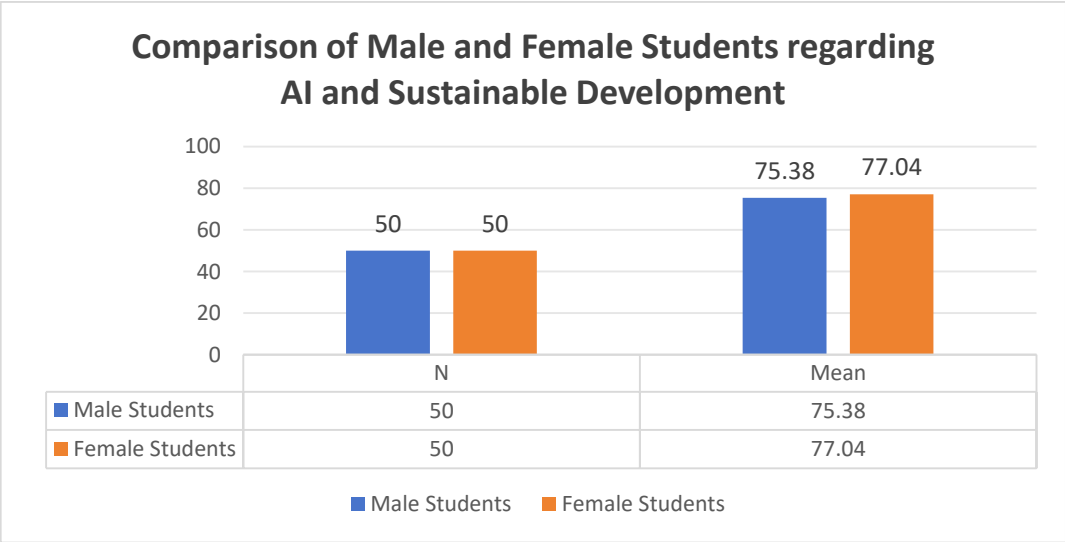
Table 2 Comparison of Male and Female Students regarding AI and Sustainable Development

Group	N	Mean	SD	t-value
Male Students	50	75.38	8.92	1.12
Female Students	50	77.04	8.47	

Interpretation

The female students had marginally higher perception ratings than the male pupils. However, the change was not statistically significant.

Fig.2: Comparison of Male and Female Students regarding AI and Sustainable Development



FINDINGS OF THE STUDY

1. The pupils from urban areas showed more awareness towards AI and sustainable development compared to the students from rural areas.

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2.Access to digital technologies altered the levels of perception of students.

3.Female students had comparably high perceptions about sustainable technology practices.

4.Students were familiarised with AI applications in health care, education and environmental management.

5.The AI ethics, jobs and privacy were the issues of concern for the responders.

Educational Implications

1."Educational institutions should raise awareness of sustainable AI practices.

2.Rural pupils should be exposed to technology and digital infrastructure better.

3.Higher education courses should include AI literacy initiatives.

4.New technology in education should be connected to ideas of sustainable development.

5.Organise workshops and lectures on ethical AI.

Suggestions for Further Research

1.Similar studies might be undertaken on instructors, professionals or school pupils.

2.Comparative study may be made of government and private organisations.

4.Studies might investigate the effect of AI literacy on environmental consciousness.

5.Research might be done on AI and sustainability entrepreneurship.

CONCLUSION

Artificial Intelligence is a powerful force to achieve sustainable growth in the many industries. The current research found significant disparities in the perceptions of urban and rural pupils about AI and sustainability. Levels of awareness are mostly determined by technological exposure, educational possibilities and digital accessibility. The research underscores the necessity to provide inclusive AI education and sustainable technology policy to maintain balanced social and economic growth.

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Appendix

5-Point Likert Scale

Perception Scale on Artificial Intelligence and Sustainable Development (PSAISD)

Instructions

Read each statement carefully and put a tick (✓) in the appropriate column according to your opinion.

Response Category	Score
Strongly Agree (SA)	5
Agree (A)	4
Neutral (N)	3
Disagree (D)	2
Strongly Disagree (SD)	1

Note: Negative statements will be scored in reverse order.

Section A: Awareness of Artificial Intelligence

S.No.	Statements	SA	A	N	D	SD
1	I am familiar with the concept of Artificial Intelligence.					
2	AI technologies are becoming important in daily life.					
3	AI can improve the quality of education.					
4	AI applications make work faster and more efficient.					
5	I have sufficient knowledge about AI tools and technologies.					

Section B: AI and Sustainable Development

S.No.	Statements	SA	A	N	D	SD
6	AI can help in achieving sustainable development goals.					
7	AI can reduce environmental pollution.					
8	AI can improve energy conservation practices.					
9	AI technologies can support sustainable agriculture.					
10	AI can help in efficient waste management systems.					

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Section C: AI in Education and Healthcare

S.No.	Statements	SA	A	N	D	SD
11	AI can improve online learning experiences.					
12	AI can provide personalized learning opportunities for students.					
13	AI technologies can improve healthcare services.					
14	AI can help doctors diagnose diseases more accurately.					
15	AI-based systems are useful in rural healthcare services.					

Section D: Ethical and Social Concerns

S.No.	Statements	SA	A	N	D	SD
16	AI may reduce employment opportunities for people. *(Negative)*					
17	AI technologies may create privacy and security risks. *(Negative)*					
18	Ethical use of AI is necessary for sustainable development.					
19	AI should be regulated by government policies.					
20	AI can contribute positively to society when used responsibly.					

Section E: Smart Technology and Future Sustainability

S.No.	Statements	SA	A	N	D	SD
21	Smart technologies can improve sustainable urban development.					
22	AI can help manage traffic and transportation efficiently.					
23	AI can improve disaster prediction and management systems.					
24	Students should receive AI literacy education in colleges.					
25	AI will play a major role in future sustainable development.					

Scoring Procedure

Positive Statements

For positive statements, scores will be assigned as:

Response	Score
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

Negative Statements

For negative statements (Items 16 and 17), reverse scoring will be used:

Response	Score
Strongly Agree	1
Agree	2
Neutral	3
Disagree	4
Strongly Disagree	5

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Interpretation of Scores

Score Range	Level of Perception
100 – 125	Very High Perception
75 – 99	High Perception
50 – 74	Moderate Perception
25 – 49	Low Perception

Dimensions of the Scale

Dimension	Item Numbers
Awareness of AI	1–5
AI and Sustainability	6–10
AI in Education & Healthcare	11–15
Ethical and Social Concerns	16–20
Smart Technology & Future Sustainability	21–25