

REALISM AND EDUCATION, ARTIFICIAL INTELLIGENCE, INNOVATIVE EDUCATION FOR A SUSTAINABLE FUTURE

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Abstract

This study explored the intersection of realism in education, the integration of Artificial Intelligence (AI), and innovative educational practices for a sustainable future. Realism, with its emphasis on objective knowledge and empirical truth, provides a philosophical grounding for using AI-driven technologies and tools to enhance educational outcomes to assist for sustainable future. This research examines how realistic epistemology and curriculum design can be aligned with innovations in AI to foster sustainable development goals (SDGs), particularly quality education (SDG 4). This paper employed qualitative and secondary data analysis, and drew insights from contemporary literature, policy documents, and empirical reports. The findings revealed that the realist philosophy supports the adoption of AI as a tool for delivery of practical and empirical, real-world learning outcomes or experiences. However, challenges such as ethical concern, digital inequality, bias, and pedagogical readiness remain.

Keywords: Realism, Education, Artificial Intelligence, Innovation, Sustainable Development

Introduction

Realism is a philosophical approach that views reality as objective and independent of human perception. In education, realism emphasizes practical, observable knowledge, focusing on facts, scientific methods, and real-world applications. In the modern age, Artificial Intelligence (AI) and innovative teaching techniques align with realism by enhancing objective learning, data-driven instruction, and evidence-based educational practices for a sustainable future. This paper examines how realism influences education and how it integrates with AI and innovative pedagogies for 21st-century learning, to the achievement of the SDGs goals in Nigeria.

Statement of the Problem

Despite the global focus on sustainability and digital transformation, many educational systems, particularly developing countries like Nigeria, remain rooted in outdated methods. There is disconnection between a realist philosophy of education which emphasizes practical, experiential knowledge and current teaching methods and practices. Additionally, the integration of artificial intelligence (AI) in education in Nigeria is often underutilized or poorly aligned with pedagogical goals. Therefore, there is need to explore how realism can serve as a foundation for AI-support and innovative education that prepares learners for a sustainable future.

Objectives of the Study

The following objectives are stated, to:

- i. analyze the philosophical principles of realism and their application in contemporary education.
- ii. examine the use of artificial intelligence (AI) in promoting realistic, experiential learning.
- iii. assess how innovative teaching methods, supported by AI-tools contribute to education for sustainable development.
- iv. To identify the challenges and opportunities associated with integrating AI in education from a realist perspective.

Research Questions

The following research questions were posted to guide the study:

- i. How can realism as a philosophical foundation inform the integration of artificial intelligence (AI) in education?
- ii. What is the role of AI in promoting innovative teaching techniques aligned with sustainable developments goals?
- iii. How do educators perceive the value of realism and AI integration in promoting sustainability-focused education?
- iv. What challenges hinder the effective implementation of AI and innovative education in realistic learning environment?

Methodology

The study adopts a qualitative research design, relying on documentary analysis of curriculum, AI policy frameworks, existing literature, reports, and scholarly articles. Data are thematically analyzed to identify recurring patterns and conceptual relationship between realism and education, Artificial Intelligence (AI), innovative education and sustainable development.

Philosophical Foundations of Realism in Education

Realism is a philosophical orientation grounded in the belief that reality exists independent of human perception, cognition or language. It emphasizes the existence of an objective world that can be known through senses and rational inquiry. In the context of education, realism provides a framework for the understanding of truth-corresponding to sensory facts and reality, knowledge and nature of existence. It asserts that education must be grounded in the real world, focusing on facts, practical knowledge, and observable phenomena (Ozmon & Craver, 2012).

Core Tenets of Realism:

1. *Objectivity:*

Realism holds that the world or reality exists independently of the human mind, thoughts, beliefs and perceptions. Reality is not constructed by our minds; rather, our minds discover or uncover reality.

The implication in education is:

- a. That education should focus on the physical world, observable facts, and scientific inquiry and not rely on perceptions, beliefs and thoughts that may be wrong.
- b. Learners must interact with the real environment to acquire true knowledge.

2. **Empiricism and Sensory Experience:**

Realists believe that knowledge comes primarily through sensory experience. Sense organs help in the acquisition of sensory experience. The sense organs are specialized parts of the body that detect and respond to different types of stimuli from the environment. They play pivotal roles in helping us to gain knowledge and interact with the world around us.

There are five (5) sense organs. These help in sensory experiences. These organs contained specialized sensory receptors. The receptors convert stimuli into electrical signals. The signals are sent via nerves to the brain for interpretation. The nervous system connects all sense organs and coordinates the responses.

The sense organs are:

- a. The Eye: This helps for the sense of sight (vision). It gives the stimulus of light and helps to detect light, colors, see shapes, movement, distance and objects among others.
- b. The Ear: It produces the sense of hearing (audition) and sound. This detects sound vibrations.
- c. The Nose: this produces the sense of smell (olfaction). It detects the stimulus of odor molecules, different smells and contributes to the sense of taste.
- d. The Tongue: it produces the sense of taste (gustation). It identifies different tastes, flavors such as sweet, sour, bitter, salty, milky, umami.
- e. The Skin: it produces the sense of touch (tactile). It helps detect stimulus of pressure, temperature, and pain sensations.

3. Correspondence Theory of Truth

Realism adopts the view that a statement is true if it corresponds to facts or reality by tasting them with any of the five sense organs by either hearing, seeing, touching, tasting, or smelling. This theory postulates that truth is discoverable and not merely a matter of consensus or coherence with beliefs systems.

4. Rejection of Idealism and Relativism

Realism stands in opposition to idealism, which states that reality is a mental construct and based on beliefs, thoughts and perceptions. It also opposes extreme relativism that denies the possibility of objective knowledge and correspondence truth. For relativism asserts that truth, knowledge and morality are dependent on cultural, historical, or personal perspectives. It challenges the idea of universal or objective truth and knowledge that apply across all contexts.

Historical Foundations of Realism and Major Philosophers

Aristotle (384-322 BCE)

Aristotle is considered the father of realism. He was an Ancient and Classical Philosopher. Unlike his teacher Plato, who believed in the World of Ideal Forms (Idealism), Aristotle argued that reality exists in the physical world and can be known through empirical observation and logical reasoning in learning. He believes that substances (real objects) have a real existence independent of our minds, perceptions and thoughts and that knowledge is derived from sensory experience. He stated that there is nothing in the intellect that was not first in the senses. He also advocated the classification and study of the natural world through observation.

Thomas Aquinas (1225-1274)

Thomas Aquinas integrated Aristotelian realism with Christian theology. He claimed that reality is intelligible and that human reason can understand truths about the world with God. He argued that both reason and faith are valid ways to understand reality. He stressed that knowledge begins with sensory experience but is perfected through intellectual abstraction. Reality during this period (Medieval Scholasticism), upheld the belief that universals (like “man” and “tree”) exist in things and can be known by the man.

Francis Bacon (1561-1626)

Francis Bacon developed the scientific method based on inductive reasoning and empirical/scientific observation or investigation. He believed that nature should be studied objectively, which underpins modern scientific realism.

John Locke (1632-1704)

John Locke emphasized experiential learning through the senses. He argues that the mind is a “blank slate” (*tabula rasa*) and that knowledge through experience write on it (the mind) to develop reason. He believes that knowledge comes from sensory experiences. Locke distinguished between primary qualities (objective knowledge), which comes from sensory experiences and secondary qualities (subjective knowledge), which comes from thoughts and perceptions.

Educational Implications of Realism

Realism as a philosophical standpoint in education influences the curriculum design, teaching methods, student-teacher relationships, and the goals of learning.

1. Curriculum Development

- a. *Emphasis on core subjects*: realism promotes a structured and systematic curriculum focused on the natural sciences, mathematics, history, geography and language-subjects grounded in observable reality. These subjects provide learners with factual and objective knowledge necessary for functioning in the real world.
- b. *Discipline-Based Education*: realism believes that each discipline has its own body of knowledge and methods for discovering truth. That, learners should follow logical progression from simple to complex, known to unknown.

2. Teaching Methods

- a. *Empirical and Scientific Approach*: That learning should be based on observations, experimentation, and logical reasoning. The scientific method is valued as a way to investigate and understand the world.
- b. *Objectivity in Instruction*: Teachers are encouraged to present facts and concepts as they are, avoiding excessive subjectivity or emotional bias.
- c. *Use of Teaching Aids*: Realism supports the use of audio-visual materials, models, field trips, and laboratory work to bring learners in direct contact with real-life situations.

3. Role of the Teacher

- a. The teacher is seen as a knowledge expert, guide, and facilitator who introduce learners to the external world or real-world learning experiences.
- b. The teacher should be rational, disciplined, and competent in content delivery.
- c. Moral education is also part of the teacher’s role. Students should learn about right and wrong through real-life situations and examples.

4. Role of the Student

- a. Students are considered rational beings capable of understanding the world through their senses and reason.
- b. They must be active participants in learning by observing, questioning, and experimenting.
- c. Realism encourages self-discipline, critical thinking, and problem solving skills on the students.

5. Educational Goals

- a. In realism, the ultimate goal of education is to help students understand the natural laws and social structures that govern the world and assist them to discover the truth or knowledge by experimentation and investigation.
- b. Education prepares the students to practical life, civic responsibility, and intellectual development.
- c. Emphasis is placed on truth, moral values, and responsible citizenship.

6. Discipline and Moral Development

- a. Realists emphasized that students should develop self-control and respect for authority.

- b. Moral education is grounded in real-world consequences rather than abstract ideals or beliefs. That is, it trains the mind of the student to understand reality accurately.
- c. It teaches students to be responsible citizens who understand social and political systems.

7. Evaluation and Assessment

- a. Realism supports objective assessment method such as Standardized tests, Quizzes, Practical tasks and demonstrations.
- b. The aim is to measure retention, understanding, and application of factual knowledge.

8. STEM Education

Realism aligns with global push for Science, Technology, Engineering and Mathematics (STEM). STEM Education refers to the integrated teaching and learning of Science, Technology, Engineering, and Mathematics. It emphasizes interdisciplinary and applied learning to equip students with critical thinking, problem-solving, creativity, innovation, and collaboration skills. Science encourages inquiry, observation, experimentation, and explanation of natural world. Technology involves using tools and digital platforms to solve problems and perform tasks. Engineering applies science and mathematics to design and build systems, structures, and innovations, while, Mathematics provides analytical and quantitative tools for problem-solving and logical reasoning.

- 9. **Evidence-Based Learning:** Realism placed emphasis on measurable outcomes and data-driven instruction.
- 10. **Carrier Oriented-Curriculum:** Realism prepares students for real-world challenges and skills via the teaching of what is needed in this world of science, technology, Artificial Intelligence (AI) and vocational knowledge.
- 11. Learning is grounded in experimentation, discovery, and verification.

Types of Realism

- i. Metaphysical Realism - This emphasizes that the external world is independent of perception or thought.
- ii. Epistemological Realism - This asserts that it is possible to know the world as it truly is.
- iii. Moral Realism - This holds that moral values and duties are objective and exist independent of human beliefs.
- iv. Scientific Realism - This claims that scientific knowledge and theories describe the world as it is and that unobservable entities (like electrons) truly exist.

Artificial Intelligence (AI) in Realist-Based Education

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, especially computer systems. AI in education refers to the use of AI tools like machine learning, natural language processing, chatbots, and data analytics, and robotics into teaching, learning and administrative processes (Luckin *et al*, 2016). AI can offer realistic simulations, data-driven feedback, and customized curricula, aligning closely with realist principles. Scholars like Holmes *et al* (2012) have noted that AI has the potentials to democratize access to quality education and equip learners with relevant skills for the 21st century workplace.

The Key Areas of AI

- i. Machine Learning (ML): Algorithms that enable computers to learn from and make decisions based on data.
- ii. Natural Language Processing (NLP): enables machines to understand, interpret, and respond in human language.

- iii. Computer Vision: allow computers to interpret and process visual information from the world.
- iv. Robotics: systems that control physical robots capable of performing tasks.
- v. Expert Systems: mimics the decision-making ability of human expert.

AI as an Extension of Realist Principles:

- a. Uses data analytics to support evidence-based instruction.
- b. Promotes adaptive learning based on measurable student performance.
- c. Facilitates knowledge acquisition grounded in factual content.

Applications of AI in Education:

- a. Intelligent Tutoring Systems (ITS): these systems provide one-on-one tutoring and feedback without human intervention (e.g., Carnegie Learning).
- b. Automated Assessment Tools: these tools can assess answers and essays, objectively evaluate writing, math, and problem-solving skills.
- c. Chatbots and Virtual Assistants: Support learners with real-time Q&A and academic guidance (e.g., ChatGPT in tutoring).
- d. Administrative Support: AI-powered tools streamline tasks like admission, scheduling, and student progress tracking. Chatbots can answer routine queries, improving students support.
- e. Learning Analytics: helps analyze large sets of student data to identify at-risk students or predict outcomes, allowing for early intervention. That it helps track student progress, predict challenges, and inform intervention strategies.

Innovative Education

The philosophy of innovative education is rooted in the belief that traditional models of education that prioritize rote learning, standardized assessment, rigid curricula are no longer sufficient for addressing the challenges of this changing and demanding world. It advocates for learner-centered, flexible, and creative approaches that integrate technology, critical thinking, creativity, collaboration and real-world problem-solving into teaching and learning. This philosophy values both the transmission of knowledge and the cultivation of skills, attitudes, and dispositions necessary for lifelong learning and adaptability. It is rooted in constructivist, humanist, and progressivist educational theories and aims to prepare learners to be adaptive, lifelong thinkers in a dynamic world.

Innovative education involves the use of tools, methods, and pedagogical approaches that respond to global challenges (UNESCO, 2020). Innovative education aligns with realist-based education and realist education aligns well with sustainable development agenda, particularly by promoting critical thinking and real-world problem-solving (Tilbury, 2011). Integrating sustainability into curricula ensures learners are prepared to address ecological, social and economic challenges in the society.

Philosophical theorist of educational aims that aligns with innovative education are briefly discussed below:

- i. **Constructivism:** Innovative education is influenced by constructivism. This theory asserts that learners construct knowledge through experiences and social interactions (Piaget, 1952, Vygotsky, 1979). It explains that the learner must be ready to explore and develop ideas in the learning process to help solve societal needs.
- ii. **Progressivism:** This emphasis that education should be based on experience and reflection and that the learner must be active and not passive. Dewey (1938), propounded this theory and laid down

experiential learning. Dewey criticized passive learning and advocated for a democratic, student-centered model that aligns closely with modern innovative educational practices.

- iii. **Humanistic Theory:** Carl Rogers (1969) highlighted the importance of the learner's self-concept and intrinsic motivation, proposing that meaningful learning occurs in environments that support autonomy, empathy, and self-direction. These ideas underscore the importance of emotional intelligence and personal relevance in learning, both key aspects of innovative education.

Key Tenets of the Philosophy of Innovative Education

1. **Learner-Centered and Personalized Learning:** Innovative education rejects the "one-size-fits-all" model, instead embracing differentiation and personalization. According to Tomlinson (2003), effective instruction must consider students' readiness levels, interests, and learning profiles. In this model, educators must serve as facilitators and foster learner autonomy to enable him or her develop creativity, critical thinking and experience.
2. **Creativity and Critical Thinking:** the emphasis on fostering creativity and critical thinking is central to innovative education. Robinson (2011) contends that traditional education systems, designed during the industrial era, often suppress creative potential of the learner. Innovative education nurtures and cultivates divergent thinking, encourages students to generate original ideas and challenges assumptions (Craft, 2005).
3. **Technology Integration:** Digital literacy and technological fluency are essential in modern society. Innovative education advocates for the integration of information and communication technology (ICT) into teaching and learning (Bergmann & Sams, 2012).
4. **Collaborative and Social Learning:** Innovative Education emphasis collaborative group work, peer learning, and project-based learning. This strategy nurture communication skills, teamwork, and knowledge co-construction.
5. **Interdisciplinary and Problem-Based Learning:** Innovative education promotes cross-curricular approaches that reflects real-world problem and encourage students to explore, investigate, and solve authentic challenges. It helps build transferable skills such as research, analysis, and communication (Hmelo-Silver, 2004).
6. **Global and Sustainable Perspective:** Innovative education incorporates global citizenship and sustainability education. Learners are encouraged to think globally and act locally, for the sustenance of the environment (Sterling, 2001).

Sustainable Development Education

Sustainable development education refers to the process of equipping learners with knowledge, skills, attitudes, and values necessary to shape a sustainable future. It promotes environmental integrity, economic viability, and a just society for the present and future generations. UNESCO (2017) defines Sustainable development education (SDE) as "education that encourages changes in knowledge, skills, values and attitudes to enable a more sustainable and just society for all."

Goals/Objectives of Sustainable Development Education

- i. Promote awareness of the United Nations (UN) sustainable development goals (SDGs).
- ii. Foster commitment to sustainable living and responsible citizenship
- iii. Develop skills for green economies and ethical innovation.
- iv. Strengthen capacity for critical and systemic thinking.
- v. Support intergenerational equity and social justice.

Major Principles of Sustainable Development Education (SDE)

- i. Holistic and interdisciplinary learning: It connects environment, social, legal, and economic perspectives.
- ii. Value-Driven: Promotes human rights, peace, equity, and cultural diversity.
- iii. Critical Thinking and Problem-Solving: Encourages learners to critically evaluate and act on sustainability issues.
- iv. Multi-Method Approach Uses participatory learning methods including dialogue, collaboration, and experiential learning.
- v. Locally Relevant but Globally Aware: Focuses on local problems with a global sustainability context.

Relationship between Realism and Artificial Intelligence (AI) and Innovative Education

- i. Problem-Based Learning (PBL): Students solve real-world problems using empirical investigation.
- ii. Project-Based Learning: Learners engage in hands-on projects tied to practical and observable phenomena.
- iii. Blended and Flipped Classrooms: Combine face-to-face realism-based activities with AI-supported online resources.
- iv. Gamification and Simulations: Use realistic scenarios in virtual environments to teach complex concepts.
- v. Data-Driven Instruction: Teachers use AI tools to analyze performance data and personalize content delivery.
- vi. Augmented Reality (AR) and Virtual Reality (VR): Create immersive experiences that simulate realistic environments (e.g., virtual labs).

Benefits of Integrating Realism, Artificial Intelligence (AI), and Innovative Education for Sustainable Development Education

- i. Promotes critical thinking and empirical inquiry.
- ii. Encourages personalized learning paths based on factual data.
- iii. Enhances student engagement with realistic and relevant content.
- iv. Fosters lifelong learning skills—problem-solving, collaboration, and adaptability.
- v. Bridges theory and practice, ensuring learners are prepared for real-world challenges.
- vi. Efficiency: reduces time spent on administrative tasks
- vii. Accessibility: supports inclusive education by providing tools for students with disabilities (e.g. speech-to-text, screen readers)
- viii. Engagement: gamification and interactive AI system can make learning more engaging and enjoyable.
- ix. Scalability: enables large-scale personalized education (e.g., MOOCs).

Challenges and Ethical Considerations

- i. Over-reliance on technology may reduce human interaction.
- ii. Bias in AI systems could skew assessment or support and amplify inequalities.
- iii. Teacher Role Re-definition: some fear that AI could reduce the role of human teachers thereby causing loss of jobs.
- iv. Privacy concerns regarding student data collection and usage.
- v. Lack of trained teachers in digital pedagogy and AI literacy and appropriate learning materials.
- vi. Inadequate infrastructures especially in developing countries.
- vii. Resistance to curriculum change and rigidity in curriculum.

viii. Funding constraints and policy gaps

Recommendations

- i. AI-Empowered Teachers: Rather than replacing teachers, AI can act as a supportive tool in the teaching and learning process.
- ii. Adaptive Learning System: More sophisticated systems that understand emotional and cognitive states
- iii. Ethical AI Education: Training students and educators on ethical AI use is becoming essential.

Conclusion

Realism provides a foundational philosophy that complements the practical, evidence-based nature of Artificial Intelligence and innovative teaching. Together, they shape an educational model grounded in reality, enriched by technology, and focused on preparing learners for the real world. A realist-informed education system equipped with AI and innovative pedagogy not only teaches knowledge but builds skills, adaptability, and critical understanding for the future.

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