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Fostering Honesty and Integrity in the Age of Gen-AI: Rethinking Ethical Scientific Attitudes in Science Education Research

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Abstract

The rapid adoption of Gen-AI tools such as ChatGPT and Gemini in science education has created unprecedented opportunities for learning, while simultaneously threatening core ethical scientific attitudes. This conceptual paper examines how honesty and integrity, as foundational values in science, are being tested in an AI-mediated educational environment. The paper argues that the ease of fabricating data, generating lab reports, and obscuring AI use necessitates a rethinking of how ethical scientific attitudes are taught, assessed and modelled in science education research. Based on literature in science ethics and educational technology, a three-dimensional ''AI Disclosure-Accountability Model'' is proposed emphasizing truthfulness in reporting, transparency in AI use, and responsibility for verifying AI outputs. The paper further discusses pedagogical strategies, assessment redesigns, and institutional policies needed to foster honesty and integrity among students and researchers. It concludes that intentional cultivation of ethical attitudes is essential to preserve the credibility and integrity of science education in the age of Gen-AI.

Keywords: Gen-AI, ethical scientific attitudes, honesty, integrity, science education research, academic integrity

1 Introduction

Artificial intelligence (AI) is a complex evolution of technology that is revolutionizing the global landscape. Gen-AI are computer programs capable of creating original content in form of text, images, audio or video. Kumar and Sharma (2024) define Gen-AI as a subset of AI models designed to generate new content that is similar to data it has been trained on. These programs are designed to demonstrate originality by mimicking human creativity. According to Ayua et al. (2026) Gen-AI is being integrated into all areas of human endeavour. In education, Gen-AI such as ChatGPT, Gemini, and others has a strong acceptance and utility today among both students, and teachers. In science, mathematics and research, Gen-AI is very useful because it helps analyse large amounts of data, make predictions, and solve complex problems quicker and efficiently than traditional methods. Science is a factual and verifiable enterprise that is based on evidence that can be observed, measured, tested, and confirmed through systematic investigation. The goal of science education is to equip students with the skills to carry out scientific processes. One of the ways through which this goal is achieved is through science education research (Ayua et al., 2026).

Research is an honest academic activity that involves the collection of relevant data so as to become thoroughly informed about an engaging topic for the purpose of making valid contribution to knowledge and proffering solutions to the identified problem(s). For research findings to be authentic, the research process must be credible. This means a compromise in the research process directly impacts the credibility of the results and lead to misinformation. In other to ensure honesty in science education research, the research process must be guided by ethical scientific attitudes. Ethical scientific attitudes are the values that guide the responsible conduct of scientific investigation and the application of scientific knowledge. To Ayua (2018a), and Ayua and Gamat (2018), ethical scientific attitudes are the values that serve as guiding principles to scientist in the course of doing science. These attitudes include values like honesty, integrity, objectivity, open-mindedness, responsibility, cooperation, humility, and respect for evidence among others.

2 Theoretical Anchorage

This study is fastened on Kohlberg's Theory of Moral Development (Kohlberg, 1981). The theory, first proposed in Kohlberg's doctoral dissertation (Kohlberg, 1958), postulated that moral reasoning is not inborn but develops progressively by social interaction with rules, norms, and ethical dilemmas within a given environment. Kohlberg contended that people

advance through three levels of moral reasoning (pre-conventional, conventional, and post-conventional) with each level encompassing two diverse stages, totalling six stages of development (Kohlberg, 1981). At the pre-conventional level, moral decisions are built on escaping of penalty and self-interest. At the conventional level, individuals adapt to societal rules, laws, and expectations to get approval and maintain social order. At the post-conventional level, reasoning is steered by adopted ethical moralities and universal human rights, even when such principles conflict with laws or authority (Kohlberg, 1981).

This implies that in the age of Generative AI, science education researchers and students are faced with new ethical dilemmas involving data fabrication, plagiarism, AI-assisted writing, and misrepresentation of findings. This theoretical framework submits that the ability to uphold honesty and integrity in scientific practice depends on the level of moral reasoning attained by an individual. If scholars operate predominantly at the pre-conventional or conventional levels, they may be tempted to misuse Gen-AI tools to evade detection or to conform to "publish or perish", and nowadays "visible or vanish" pressures. Nevertheless, nurturing scientific attitudes at the post-conventional level (where actions are guided by universal principles of truth, accountability, and respect for intellectual property) becomes critical for sustaining ethical scientific conduct. Consequently, this paper contends that rethinking ethical scientific attitudes in science education research requires cautious educational interventions that move scholars beyond rule-compliance towards principled moral reasoning. By so doing, honesty and integrity can be adopted as professional values rather than mere responses to institutional sanctions in the Gen-AI era.

2.1 Background: Rise of Gen-AI in Science Education Classrooms Research

Gen-AI is rapidly transforming the landscape of science education and research. Gen-AI tools such as ChatGPT, Gemini and other AI-powered models are capable of generating text, solving problems, assisting with data analysis, and creating simulations. These abilities have facilitated their use in classrooms and in research. Ayua (2018c) notably stated that science education research should keep pace with the paradigm shift of technology. In science classrooms Gen-AI can make concrete what would otherwise be abstract by generating images, videos and simulations. Gen-AI accelerates the science education research process by assisting with literature reviews, data analysis and interpretation and research-report writing.

2.2 The Tension: AI as a Learning Tool Vs AI as a Tool for Misconduct

AI has become a useful learning tool due its ability to concretize and personalize learning, offer direct learning assistance, evaluation and feedback. However, it could be perceived as a two-edged sword, simultaneously posing serious risks. The other edge of the sword emerges when AI becomes a tool for misconduct (Chan et al., 2023). Students may rely on AI to do assignments without understanding the material, falsify research data and present false findings. In this scenario, AI is no longer used as a learning tool but as a tool for misconduct.

2.3 Statement of the Problem

The integration of Gen-AI has transformed the teaching/learning of science and research; providing limitless/instantaneous academic assistance. However, AI usage raises concerns about academic honesty and integrity (Cooper, 2023; Cotton et al. 2023). Students now generate assignments, laboratory reports, and research responses with minimal personal effort. It is difficult for educators to determine the originality/authenticity of academic work. In this notable and worrisome AI tools misuse, most educators are probably evaluating machines rather than students because assignments and research are largely generated by AI. Ayua (2018c) stated that changes and challenges in society should be met by an evolution of curriculum and educational policies to combat that change. However, there is little available literature on frameworks that can guide the use of AI in science education and research to conform with ethical scientific attitudes of integrity and Honesty. It is therefore most relevant and timely to conceptualize a framework to emphasize the core ethical scientific attitudes which could mitigate against the unethical use of AI in science education classrooms and research.

2.4 Purpose and Significance of the Paper

This paper aims to: Emphasize the need for honesty and integrity among students and researchers in the post-AI era, discuss pedagogical strategies for fostering these ethical scientific attitudes, and propose an accountability model for AI use in science education and research. This study would benefit: Students and researchers through the accountability model for

responsible AI use; science educators via strategies for academic integrity; and policy makers by clarifying ethical concerns to guide policies on AI in education and research.

3 Literature Review

Ethical scientific attitudes, Gen-AI in science education, Documented cases of AI-assisted misconduct, and Existing frameworks for academic integrity in the pre-AI era and their limitations are reviewed.

3.1 Ethical Scientific Attitudes

Ethical scientific attitudes are values that guide the responsible conduct of scientific investigation and the application of scientific knowledge. According to Ayua (2018b), these attitudes include but are not limited to honesty, integrity, objectivity, and respect for evidence. Honesty entails fairness and adherence to facts throughout the research process, while integrity requires the use of verifiable and ethically acceptable methods in proposing, performing, and reporting research (Ayua, 2018b; Resnik, 2015). Objectivity demands that observations and conclusions be based on facts rather than sentiment or personal opinion, and respect for evidence prioritizes observable and verifiable data over emotions or authority. Beyond these, ethical practice also encompasses responsibility for the safety and social implications of research (Macrina, 2014), open-mindedness to new ideas and contradictory findings, cooperation through data sharing and proper attribution (Resnik, 2015), and humility in acknowledging errors and limitations (Macrina, 2014). Collectively, these attitudes ensure that science is conducted with integrity, fairness, and accountability to society, thereby distinguishing the moral conduct of science from purely intellectual capacities such as curiosity or critical thinking (Ayua, 2018b).

3.2 Generative-AI in Science Education

Gen-AI has many positive applications in science education. According to Kasneci et al. (2023) Gen-AI models such as ChatGPT and other AI- chatbots can act as intelligent tutors, offering personalized learning experience and support. These tools can help students keep pace with the class, foster understanding, and help students visualize science concepts. Perkins (2023) posits that Gen-AI tools can enhance scientific inquiry and critical thinking by generating hypotheses and proposing experimental designs. Similarly, according to the United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2023; Holmes, 2023) AI technologies can contribute to inclusive education, providing adaptive support for learners with disabilities and those in under-served communities by improving access to learning resources. Despite the opportunities of Gen-AI, it presents some challenges as well. According to Kasnaci et al. (2023) these tools can generate inaccurate or fabricated information, scientifically incorrect explanations. In science education where factual accuracy is essential, such errors can lead to misconceptions. Zhai (2023) noted that Gen-AI tools could lead to inadequate development of practical scientific skills, arguing that these tools cannot replace hands-on laboratory experiences because authentic scientific inquiry depends on direct interaction with scientific equipment and phenomena.

3.3 Documented Cases of AI-Assisted Misconduct

Fabrication of data has serious consequences on the general community that relies on these publications to make informed decisions about society (Elali & Rachid, 2023). There have been recorded cases of AI-assisted misconduct specifically in generating fabricated data, ghost writing, and inventing fake citations. Elali (2023) published AI generated abstracts using ChatGPT. In 2023 a lawyer was fined for admittedly using ChatGPT to generate fake case citations and presenting in a United States Court (Bohannon, 2023). Similarly, Spinellis (2025) reported cases of AI generated articles credited to other researchers.

3.4 Existing Frameworks for Academic Integrity in the Pre-AI Era and their Limitations

The concept of academic integrity has existed pre-AI. Existing frameworks for academic integrity include:

The Comprehensive Academic Integrity (CAI) Framework: This framework by Eaton (2023) viewed academic integrity as a function of eight elements: everyday ethics, institutional ethics, ethical leadership, professional and collegial ethics, instructional ethics, student academic conduct, research integrity and publication ethics. Relatedly, Akgun and Greenhow

(2022) and Sadasivan et al. (2023) linked AI to ethics/moral development in education as a good bridge to Kohlberg's theory used in Gen-AI detection to ensure integrity in research across disciplines.

Legal framework: Copyright law protects academic property from unauthorized duplication and distribution and spells out consequences for violations and plagiarism.

Limitations: These frameworks define academic dishonesty in light of replicating academic content authored by someone else without due acknowledgment or approval. However, they do not account for machine generated content being credited to a human source hence the need for an academic integrity framework that addresses the misuse of AI which is the present-day dilemma.

4 Conceptual Framework

Redefining honesty and integrity for AI mediated science work, the AI Disclosure-Accountability Model for science education research, and how this framework connects to core scientific values are discussed

4.1 Redefining Honesty and Integrity for AI-Mediated Science Work

AI-mediated science work refers to the scientific process undertaken with the aid or assistance of AI. In this case AI is only a mediator, facilitating the scientific process for efficiency and effectiveness. Honesty in AI-mediated science work entails acknowledging the role of AI as used in the scientific process and not crediting AI generated content as human ideas. Integrity in science entails keeping with what is acceptable-process and ensuring authenticity and originality. For AI-mediated science work integrity implies verifying AI generated content and ensuring the scientific process is actually carried out. In the post AI era, research integrity places responsibility on the researcher to verify AI generated outputs such as citations, literature reviews, data analysis and interpretation. The researcher is responsible for the conclusions drawn from his research.

4.2 The 'Ai Disclosure-Accountability Model' for Science Education Research

The AI Disclosure-Accountability Model comprises of three key dimensions:

Dimension 1: Truthfulness in data and reporting: Research conclusions are based primarily on the data obtained through the scientific method. Truthfulness in data and reporting means research data should not be falsified; and that data obtained should be reported as obtained. AI should not be used to generate false data.

Dimension 2: Transparency in AI use: Transparency in AI use means to be honest about the role and use of AI in science education research. AI generated output and inputs should be duly acknowledged. Transparency in science and research traditionally means clearly providing the road-map (methodology) the researcher used to arrive at the said conclusion or outcome. This is because scientific outcomes should be replicable, verifiable and disprovable.

Dimension 3: Responsibility for verifying AI outputs: Documented cases of AI fabricated data make it necessary to verify AI generated outputs such as citations, references, literature reviews and facts. Gen-AI models are trained with large collections of data and these form the basis of what it identifies as fact whether they are true or not.

4.3 How This Framework Connects to Core Scientific Values?

Science and research are honest, transparent endeavours guided by evidence rather that sentiments. The AI Disclosure-Accountability Framework is a guiding system that incorporates the core scientific attitudes of honesty, integrity, transparency and respect for evidence in post-AI era of science education and research. The framework does not prohibit the use of AI but rather emphasizes honesty and integrity in its use.

4.4 Key Challenges to Honesty and Integrity in the AI Age

Ease of fabrication, Attribution Problems, Assessment Challenges, and Over-reliance and erosion of perseverance and critical thinking, are discussed

Ease of Fabrication: The scientific process is one that requires time, resources and most times vigour. However, with Gen-AI it has become easy to fabricate data such as laboratory reports, survey responses, and other related content in a matter of seconds with just a prompt. Researchers may be tempted to fabricate data, generate false sources and citations due to the ease with which one can fabricate these outputs using AI.

Attribution Problems: Another challenge to honesty and integrity is the matter of credit. With AI generated output the question remains who is the author? This challenge leads researchers to subsume AI output as part of their own without transparent disclosure.

Assessment Challenges: As earlier noted, most educators today find themselves evaluating a machine and not their students. Assessment is meant to facilitate learning however, the wide use of AI has made it harder to differentiate between human thinking and creativity, and AI content. Most students use AI in solving mathematics problems, doing assignments and research most notably without understanding the content themselves which defeats the purpose of assessment.

Over-reliance and erosion of perseverance and critical/creative thinking: Critical thinking is an important cognitive ability in science education. Meanwhile, creative thinking is the ability to generate innovative, novel and valuable ideas through an open-minded, flexible, and imaginative thought process that combines existing knowledge and experiences in fresh and surprising ways (Terhemba & Ayua, 2025). Critical/creative thinking are hinged on imagination and experimentation. Over-reliance on AI erodes critical thinking by eroding imagination which results in the inability to generate innovative ideas. AI becomes the go-to response for people who are over reliant on AI; leaving no room for cognitive development resulting in critical thinking and perseverance because AI offers quick solutions to difficult task.

4.5 Strategies for Fostering Honesty and Integrity

Pedagogical strategies, Assessment redesign, Institutional Policies, and Role of teachers as ethical role Models in an AI-mediated environment are discussed.

Pedagogical Strategies: Pedagogical strategies are educational techniques, methods or plan of classroom action or interaction intended to accomplish specific teaching/learning goals. Teachers should create teaching experiences and classroom environments that promote ethical behaviour. Ethical Scientific attitudes should be emphasized and demonstrated during experimental science lessons.

Assessment Redesign: Assessment is any educational experience that measures a learner's achievement and overall development. Assessment redesign in the context of this paper refers to the modification of existing assessment techniques in order to foster honesty and integrity. Teachers could adopt interviews and a form of assessment, collaborative group projects, and project-based assessment techniques.

Institutional Policies: Educational institutions should make and enact policies that guild the use of AI. These policies should establish clear guidelines and procedures that promote ethical behaviour and uphold academic integrity. These policies may include plagiarism policies, examination guidelines, anti-cheating regulations, and disciplinary procedures for academic misconduct.

Role of teachers as ethical role Models in an AI-mediated environment: A teacher is a role model to the students whether he or she is aware or not role. A role model is a worthy person who is a good example for others to imitate. Teachers have always been held in high esteem by students. This means students observe their teachers then simply and smartly emulate them. Teachers should model ethical values and be good examples worthy of emulation. For example, a teacher in a science experiment who falsifies data to arrive at a predetermined conclusion is not modelling objectivity, honesty, integrity, and respect for evidence. In this AI-mediated environment, teachers most show ethical values and model academic integrity for others to follow

5 Implications for Science Education Research and Practice

Implications for curriculum design in science and mathematics, implications for teacher training and development, and implications for research ethics committees and journal policies, and future research directions are addressed.

Implications for Curriculum design in Science and Mathematics: The integration of AI in education must be met with a corresponding curriculum redesign to prepare students for its use and application in science and mathematics education (Holmes et al. 2023). This is because the curriculum most evolve to address societal challenges and opportunities.

Curriculum designers should integrate AI-literacy training, and ethical use of AI in learning and research to ensure responsible use of AI tools.

Implications for teacher training and development: For educators to properly harness the opportunities that AI present in facilitating the teaching and learning of science, they must be properly trained and efficient in its use. Teacher training workshops and programs on the responsible use of AI should be organized for in-service and preservice teachers.

Implications for research ethics committees and journal policies: Research ethics committees and journal policies have a responsibility of ensuring that research process conform to ethical and acceptable standard. With the evolution of AI in science and research, research ethics committees and journals should enact policies that address the responsible use of AI (Committee on Publication Ethics [COPE] Council, 2023; Lodge et al., 2023). Journals and research ethics committees should ensure disclosure of AI use, verify AI generated output and ensure data used is not AI generated.

Future research directions: Future empirical research should focus on investigating the impact of AI on: scientific attitudes of male/female students, critical thinking development, assessment and academic integrity.

6 Conclusion

Summary of key arguments, call to action, and final thoughts on preserving the credibility of science are discussed.

7 Summary of Key Arguments

Science education and research is being overrun by AI generated output resulting in unethical academic practices of dishonesty and the disintegration of core scientific attitudes. The ease of fabrication of data with Gen-AI tools has also resulted in academic laxity among both students and researchers. Similarly, the over-reliance on AI for doing assignments, solving problems, and conducting research will eradicate the scientific process which is crucial to the integrity of scientific discovery. This can also result in underdevelopment of cognitive abilities such as critical thinking and problem-solving

8 Call to Action

The science education community must act swiftly, intentionally cultivating ethical scientific attitudes in students and researchers and re-emphasizing due diligence in carrying out the scientific method so as to survive the AI age.

9 Final Thoughts on Preserving the Credibility of Science

Science is trusted because it follows systematic process for investigating and verify knowledge. The credibility of science is dependent on the scientific method and the scientific attitudes that ensure this method is adhered to. To preserve the credibility of science, we must foster honesty and integrity in this age of Gen-AI and rethink ethical scientific attitudes in science education and research.

10 Declarations

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TCK: Developed the paper outline and co-edited it with GAA.

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