

Educational Implications of Bioethical Issues

Dr. Salam Sangrila Devi

Assistant Professor, D.M. College of Teacher Education (DMCTE), Government of Manipur, Imphal

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ABSTRACT

Background and problem. Science and technology have transformed human life, yet school and university curricula largely familiarise students with the benefits of scientific inventions and discoveries while leaving little scope to examine their ethical consequences and limits. Bioethics education is now well established in medical and health-professional programmes, but its presence in general education remains limited and uneven.

Purpose and objectives. The paper aims to clarify the meaning and scope of bioethics and bioethical issues; to review the status of bioethics education in India and abroad; to examine what policy documents and research indicate about the place of ethical consequences in school and university education; and to make the case for introducing bioethics as a formal discipline of study across all levels of education and all subject streams.

Approach and method. *The study is a conceptual and policy paper that uses a descriptive-analytical approach.* The research relies on secondary sources, encompassing peer-reviewed studies, national and international policy papers, and institutional curriculum materials. *No primary data were collected.*

Major findings. The analysis identifies (i) an institutional gap between medical and general education; (ii) an implementation gap between stated policy aspirations for ethical reasoning and classroom practice; (iii) growing international and national policy support, together with encouraging but still limited evidence that ethical and bioethical reasoning can be taught effectively in schools; and (iv) the disciplinary breadth of bioethics, which extends well beyond medicine.

Conclusion. The paper concludes that bioethics should be introduced as a compulsory, formal subject of study from the primary level through university, across all subject streams.

Contribution and implications. The paper offers a consolidated conceptual account of bioethics and links the case for bioethics education to India's National Education Policy 2020 and UNESCO's bioethics education framework. It directs curriculum planners, teacher educators, and policymakers towards discussion- and case-based pedagogy, teacher preparation, and systematic audits of existing syllabuses.

Keywords: Bioethics, bioethical issues, ethical issues, bioethics education, educational implications, ethical reasoning, curriculum, science, discipline.

1. INTRODUCTION

Science and technology have transformed nearly every dimension of human life, yet their advantages have consistently been accompanied by high costs. Nuclear energy, for instance, offers a genuine alternative to the depletion of non-renewable resources such as oil and coal, but its mismanagement poses a catastrophic risk. Likewise, social media, while a useful tool of connection and information, has been linked to various harms such as poor sleep, anxiety, depression, and body image concerns. The U.S. Surgeon General's advisory on youth mental health mentions many signs of a serious risk of harm to children and adolescents, besides its potential benefits (Office of the U.S. Surgeon General, 2023). Frontier biotechnology shows a similar pattern. Genome editing tools such as CRISPR-Cas9 offer the promise of treatments and prevention of disease, but also bring ethical, social, and legal questions that are of enough concern to warrant the formation of a global expert committee by the World Health Organization and the publication of a governance framework (WHO Expert

Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing, 2021). In India, the Surrogacy (Regulation) Act, 2021 permits altruistic surrogacy while prohibiting commercial surrogacy and the exploitation of surrogate mothers, an attempt in law to balance the benefits of assisted reproduction against its risks (Government of India, 2021). In much the same way, a wide array of bioethical issues, including surrogacy, in vitro fertilization (IVF), abortion, cloning, stem cell research, eugenics, genetically modified organisms (GMOs), euthanasia, organ donation, prenatal diagnosis, agricultural fertilizers, chemical pesticides, global warming, healthcare access, and animal experimentation, have remained subjects of sustained global debate.

These debates persist because each scientific advance carries both merit and consequence, and evaluating the two requires an understanding of the ethical principles at stake. Surrogacy is illustrative: while it offers an invaluable, selfless means by which one family may help another overcome infertility, the experience is not without emotional cost to the surrogate herself. Qualitative research on surrogate mothers has found that relinquishing the newborn to the commissioning couple is frequently a distressing and painful experience for the surrogate (Tehran et al., 2014). Such findings illustrate why bioethical literacy, the capacity to weigh the promise of scientific innovation against its human and social costs, cannot be assumed to develop on its own; it must be deliberately taught.

International and national policy already points in this direction. UNESCO's Universal Declaration on Bioethics and Human Rights urges member states to promote bioethics education and training at all levels (UNESCO, 2005). According to India's National Education Policy 2020, students' ethical and moral reasoning should be nurtured from early childhood (Ministry of Human Resource Development [MHRD], 2020). Teaching research suggests that such aims are achievable (Basarkod et al., 2026; Chowning et al., 2012).

Formal bioethics education is mostly delivered during the training of medical and health professionals (Ngan & Sim, 2020; Sim et al., 2019; Ten Have, 2013) and is limited and patchy in schools and, more generally, in higher education. There are also reviews of the teaching of sociocentric issues (many of which cover the same topics) that find a persistent gap between the importance acknowledged by teachers of such teaching and its implementation in classrooms (Högström et al., 2025).

1.1 Meaning of Bioethics and Bioethical Issues

The term Bioethics is a composite of "bio" and "ethics," denoting, in its broadest sense, the moral code governing human life. Potter (1970) is often credited with coining the term and presenting bioethics as a "science of survival" linking biological knowledge with human values, and Callahan (1973) later argued for its recognition as an academic discipline in its own right. It is closely related to medical and biological research that deals with issues of life and death. It is usually regarded as a branch of applied ethics that addresses the philosophical, social, and legal issues arising in medicine and the life sciences (Gordon, n.d.). Bioethics' central concern is human life and well-being, but it also sometimes encompasses ethical issues concerning the non-human biological environment, organ donation and transplantation, genetic research, end-of-life care, and environmental responsibility. Scholars are not in agreement over the extent to which the boundaries of bioethics should be drawn (Bracanovic, 2012; Kacar, 2020). Understood this way, bioethics offers a framework for examining ethical issues not only in the health and life sciences but, increasingly, across any discipline concerned with human conduct, professional or otherwise.

1.2 Bioethical Issues

Human conduct is governed by moral codes that, when contested or unclear, give rise to ethical dilemmas for individuals and societies alike. Bioethical issues, in this sense, refer to the ethical problems that arise most visibly in medical and life-science research, though their relevance now extends well beyond these fields to every discipline of study (Gordon, n.d.). As Potter (1970) and Callahan (1973) respectively characterised bioethics as a "global movement" and a "new academic discipline," it is arguable that the present education system has yet to catch up with this shift: students may graduate at every level with little formal grounding in the ethical limitations of the science they are taught to admire (see Section 5).

2. REVIEW OF RELATED LITERATURE

A review of existing scholarship indicates that bioethics education, though well established at the tertiary and professional levels in several countries, remains limited and unevenly developed at the school level, the gap this paper seeks to address.

Conceptual foundations. Potter (1970) is often credited with coining the term “bioethics” and defining it as a “science of survival,” a global movement that links biological knowledge and human values. Soon after, Callahan (1973) advocated for its recognition as a distinct academic discipline. Later, other researchers shared this view and described the interdisciplinary nature of its field (Gordon, n.d.).

Scope and limitations of the discipline. The limits of bioethics are still debated among scholars. There is a debate among bioethicists about whether bioethics should be limited to the ethical evaluation of medical treatments and technologies, or expanded to include moral concerns of all sentient beings (Bracanovic, 2012). Kacar (2020) advocates for a broader perspective and an extension of the ethical perspective, taking the bioethical debate from the domain of the environment to that of extraterrestrial policy. This paper concurs with the broader perspective that bioethics education should not be limited to medical, animal, or environmental ethics but should encompass the full range of ethical issues raised by scientific and technological change.

Institutional adoption. Empirical accounts of bioethics education point to its steady, though uneven, institutionalisation. In India, the Indian Council of Medical Research (ICMR) developed the country’s first national core curriculum for bioethics teaching in 1980 (Kumar, 2006), and the Medical Council of India’s 2019–2020 “Competency-based UG Curriculum for the Indian Medical Graduate” introduced a dedicated course, “Attitude, Ethics and Communication” (AETCOM). Comparable developments have occurred internationally: bioethics instruction is now a near-universal feature of medical education in Hong Kong (Becker, 2005), Malaysia (Sim et al., 2019), and Canada, where it is a formal accreditation requirement of both the College of Family Physicians and the Royal College of Physicians and Surgeons (McKneally & Singer, 2001). In the United States and Europe, the field has matured further still, with dedicated undergraduate majors, graduate certificates, and doctoral programmes now well established (Lee, 2016). Overviews of the field treat bioethics education as a matter of worldwide concern (Ten Have, 2013), and comparative studies of medical schools show how such programmes evolve over time (Ngan & Sim, 2020).

Ethics and bioethics in school education. Policy interest in ethics teaching at the school level is growing. Article 23 of UNESCO’s Universal Declaration on Bioethics and Human Rights encourages states to foster bioethics education and training at all levels (UNESCO, 2005), and UNESCO’s Bioethics Core Curriculum offers a syllabus, designed as a 30-hour course, built on the principles of that Declaration (UNESCO, 2016). A First Syllabus for Youth Bioethics Education, prepared by the UNESCO Chair in Bioethics (Haifa) in 2018, is directed at schoolchildren and teenagers (see Finlay et al., 2019). In India, the National Education Policy 2020 states that students should be taught from a young age the importance of doing what is right and be given a logical framework for making ethical decisions, and that in later years they should learn to argue an ethical issue from multiple perspectives (MHRD, 2020, para. 4.28). Classroom research offers supporting evidence. In a study of 431 high-school students taught by 12 teachers, students whose teachers received professional development and used bioethical case studies with structured decision-making tools produced significantly stronger reasoned positions than a comparison group (Chowning et al., 2012). A systematic review of 157 studies of socioscientific-issues teaching in primary and secondary schools found that the research centres on higher-order thinking skills and science content knowledge and that group discussion is the main teaching method (Högström et al., 2025). A recent meta-analysis of 92 randomised trials, although not specific to bioethics, found that ethics and moral education in schools and universities improved students’ moral outcomes, and that interventions with student discussion were more effective than those relying on passive information transfer; the authors nevertheless judge the overall quality of the evidence to be limited (Basarkod et al., 2026).

The gap. Taken together, this literature demonstrates that bioethics has secured a firm foothold in professional and higher education, particularly in medicine. At the school level, policy frameworks, a youth syllabus, and classroom studies exist, but bioethics has not yet been consolidated as a subject in general education at the

primary and secondary levels, nor in non-medical higher-education streams, and research on socioscientific issues reports a persistent gap between acknowledged importance and classroom implementation (Högström et al., 2025). It is this gap that the present paper addresses.

3. Objectives and Research Questions

The present paper is guided by the following objectives:

1. To examine the meaning, scope, and evolving definition of bioethics and bioethical issues.
2. To review the current status of bioethics education across academic disciplines, in India and internationally.
3. To examine what policy documents and the research literature indicate about the degree of attention given, in school and university education, to the ethical consequences, and not merely the benefits, of scientific and technological developments.
4. To propose the introduction of bioethics as a compulsory subject of study across all levels of education and all subject streams: sciences, social sciences, humanities, fine and performing arts, physical education, medicine, law, engineering, management, politics, and philosophy.

These objectives are addressed through the following research questions:

RQ1. How is bioethics defined, and how broad is its scope, in the scholarly literature?

RQ2. To what extent, and at which educational levels, has bioethics education been institutionalised in India and internationally?

RQ3. What do policy documents and research on ethics and socioscientific issues teaching indicate about the attention given to the ethical consequences of science in school and university education?

RQ4. What rationale and evidence support introducing bioethics as a compulsory subject across levels and streams?

4. METHOD

4.1 Research design

This paper adopts a descriptive-analytical approach. It is a conceptual and policy paper, not an empirical study, and therefore, no primary data were collected. Its purpose is to synthesise existing scholarship and policy and to build a reasoned argument for curricular reform, rather than to test a hypothesis.

4.2 Sources and selection

The paper draws on three kinds of secondary sources: (a) peer-reviewed journal articles, book chapters, and reference works on the definition, scope, and teaching of bioethics and ethics; (b) international and national policy and legal documents, including UNESCO instruments and curriculum documents, the World Health Organization's governance framework on human genome editing, India's National Education Policy 2020, and the Surrogacy (Regulation) Act, 2021; and (c) institutional curriculum documents and country-level accounts of bioethics education in medical programmes. Sources were selected purposively for their relevance to the objectives and research questions, with preference given to peer-reviewed and official documents and, where available, to recent publications; foundational works (Potter, 1970; Callahan, 1973) were retained for their conceptual importance.

4.3 Analytical procedure

The sources were read and organised thematically under four headings that correspond to the objectives: (i) the

definition and scope of bioethics; (ii) the institutional status of bioethics education in India and abroad; (iii) the treatment of ethical consequences and ethical reasoning in school and university education, and the evidence on how these can be taught; and (iv) the rationale for curricular reform. .

4.4 Scope and limitations of the method

Because the review is purposive rather than systematic, it may not capture all relevant literature. Because it includes neither primary data nor an audit of syllabuses, statements about the content of current curricula rest on the policy documents and research reviewed rather than on direct analysis of syllabus content.

5. The Rationale for Bioethics Education

Science is indispensable to virtually every dimension of modern life, yet humanity's relationship with it has never been one of unqualified benefit. War remains the starkest illustration of scientific misuse: the development of atomic bombs, hydrogen bombs, and ballistic missiles has repeatedly placed human civilisation in jeopardy, as the atomic bombings of Hiroshima (6 August 1945) and Nagasaki (9 August 1945) tragically demonstrated. Left unchecked, such technologies carry the potential to imperil human civilisation itself.

Yet the present education system appears to teach students the benefits of science with far less attention to its limitations, understood here as the drawbacks, harmful effects, abuses, and unintended consequences that accompany scientific progress. Research on sociocentric issues points in the same direction: scholars in the field note that traditional school science often presents science as settled knowledge unaffected by social or cultural context, and that teaching that engages with the ethical and social dimensions of science remains underimplemented (Högström et al., 2025). This asymmetry, the paper argues, is precisely what a bioethics curriculum is positioned to correct.

5.1 The Scope of Bioethics

While bioethics is often narrowly associated with medical policy and clinical practice, its scope is better understood as expansive and interdisciplinary, since practitioners of bioethics are drawn from a wide range of fields, each bringing its own ethical assumptions to bear (Gordon, n.d.). This has given rise to related sub-fields, such as teaching ethics, environmental ethics, animal ethics, feminist ethics, legal ethics, and educational ethics, among others, that together illustrate how far the discipline's boundaries can reasonably extend.

Bioethicists themselves remain divided on where these boundaries should lie (Bracanovic, 2012): some would restrict ethical evaluation to the morality and timing of medical treatments and technological interventions on humans; others would extend it to cover any action capable of harming a sentient organism. The balance of scholarly opinion, however, favours the broader view (Kacar, 2020). This paper adopts that broader position, holding that bioethics education should encompass the full spectrum of ethical questions raised by scientific and technological innovation, surrogacy, and abortion, among them, and that this knowledge should be made accessible to students at every stage of their education.

6. Bioethics Education: Status and Practice

Bioethics is presently taught at the undergraduate and graduate levels across a range of disciplines, including philosophy, medicine, law, and the social sciences, and has become a formal requirement for professional accreditation in health-related fields such as medicine, nursing, and rehabilitation sciences, typically under headings such as professional ethics, medical ethics, clinical ethics, or nursing ethics. This pattern is now visible across much of the world, from Malaysia (Sim et al., 2019) and Hong Kong (Becker, 2005) to Canada and Europe.

In India, this institutionalisation began with the ICMR's first national ethical guidelines and core bioethics curriculum in 1980 (Kumar, 2006), and matured considerably with the 2019–2020 revision of the MBBS curriculum by the Medical Council of India, which introduced the AETCOM course as a core, examinable component of medical training.

Elsewhere, the discipline has grown into a distinct academic career pathway. The United States and Europe now offer undergraduate majors and minors, graduate certificates, and full master's and doctoral programmes in bioethics (Lee, 2016). In Canada, every medical school incorporates bioethics instruction, and its inclusion is mandated by both the College of Family Physicians of Canada and the Royal College of Physicians and Surgeons of Canada as a formal condition of residency accreditation (McKneally & Singer, 2001).

At the school level, developments are more recent and more scattered. UNESCO's Bioethics Core Curriculum and its youth syllabus offer models for structured teaching (UNESCO, 2016; Finlay et al., 2019), India's National Education Policy 2020 creates a general policy opening for ethical reasoning in schools (MHRD, 2020), and classroom studies show that bioethical case analysis can strengthen high-school students' reasoning (Chowning et al., 2012). What remains to be done is the systematic incorporation of bioethics, as a defined subject, into mainstream school curricula.

What this pattern makes clear is that bioethics is no longer confined to any single field of study; it has become both a precondition for professional accreditation and, increasingly, a discipline in its own right. As Potter (1970) and Callahan (1973) each anticipated, the study of ethics does more than convey information: it equips a person to examine their own choices and actions critically, and to reason toward what is genuinely of value. It is this capacity for ethical reasoning, this paper argues, that a general education curriculum should be cultivating far earlier than it presently does.

7. FINDINGS AND DISCUSSION

The review and discussion above point to several key findings:

1. **An institutional gap between medical and general education.** Bioethics has achieved a strong institutional footing in medical and health-professional education worldwide, including in India, but its presence in school-level and non-medical university curricula is limited and uneven.
2. **An implementation gap in the ethical dimension of science education.** Policy documents such as India's National Education Policy 2020 and UNESCO's Universal Declaration on Bioethics and Human Rights call for ethical reasoning and bioethics education, and research shows that the ethical dimensions of science can be taught through socioscientific issues; yet reviews report a persistent gap between these aims and classroom practice (Högström et al., 2025). On this basis, the paper argues that science curricula continue to emphasize the benefits of scientific and technological advancement more than its ethical costs, risks, and misuses, an argument that a systematic syllabus audit would need to test (Section 7.2).
3. **International precedent and growing evidence of feasibility.** The experience of several countries (Canada, the United States, much of Europe, and India) has shown that bioethics can be successfully incorporated into formal curricula and accreditation frameworks at the professional and higher-education levels. At the school level, UNESCO's youth syllabus and classroom studies (Chowning et al., 2012) suggest that similar integration is feasible, although the evidence base for bioethics at the primary and secondary levels remains limited and largely drawn from high school settings.
4. **Disciplinary breadth.** Bioethics is larger than medicine. Its reasoning skills – weighing benefit and harm, weighing competing values, exercising judgment in situations of uncertainty – are transferable across the sciences, social sciences, humanities, and professional disciplines.
5. **Pedagogical implications.** Classroom research favours discussion-based, case-based, and argumentation-focused methods over lecture-based transmission. Group discussion is the dominant method in socioscientific issues teaching (Högström et al., 2025); ethics interventions that include student discussion are more effective than passive information transfer (Basarkod et al., 2026); and bioethical case studies with structured decision-making tools have strengthened high-school students' reasoned positions (Chowning et al., 2012).

Taken together, these findings support the paper's central proposal: that bioethics be introduced as a compulsory subject of study from the primary level through university, across all subject streams, rather than remaining the preserve of medical and health-related programmes alone.

7.1 Contribution and implications

The paper makes three contributions. Conceptually, it consolidates the definition and scope of bioethics and adopts the broader view of the field advocated in the literature (Bracanovic, 2012; Kacar, 2020). For policy, it links the proposal to existing commitments, namely Article 23 of UNESCO's Declaration and the National Education Policy 2020, and suggests that bioethics can give the general aspiration of ethical reasoning a concrete, content-rich domain. For practice, it points to the following implications:

- **Curriculum planners** can introduce bioethics in age-appropriate stages, from basic ideas of right and wrong and of consequences at the primary level to the case-based analysis of contemporary issues, such as genetic and reproductive technologies and environmental ethics, at the secondary and higher levels.
- **Teacher educators** need to prepare teachers to facilitate reasoned discussion of ethically contested issues, since the absence of socioscientific issues from teacher education has been identified as one reason they are not taught (Högström et al., 2025).
- **Policymakers and curriculum bodies**, such as the University Grants Commission (UGC), can consider cross-curricular integration in science and social science subjects together with dedicated bioethics courses at the university level, within the implementation of the National Education Policy 2020.

7.2 Limitations and directions for future research

Four limitations should be noted. First, the review is purposive rather than systematic. Second, the paper does not include an audit of school or university syllabuses, so its claims about the content of current curricula are based on policy documents and research rather than on direct syllabus analysis. Third, the evidence base for bioethics teaching, specifically at the primary and secondary levels, remains limited. Fourth, the proposal for compulsory status across all levels and streams goes beyond what current evidence directly demonstrates and should be tested through pilot implementation. Future research could therefore include content analyses of national, state, and institutional syllabuses; pilot bioethics modules with quasi-experimental evaluation; studies of teacher preparedness; and comparative studies of countries that have introduced bioethics at the school level.

8. CONCLUSION

This paper has argued for the integration of bioethics education across all levels and streams of formal education. Bioethics, understood as a discipline concerned with the interrelationship among living beings and grounded in interdisciplinary and multidisciplinary knowledge, has a legitimate claim to inclusion in every undergraduate curriculum. Establishing a closer relationship between education and bioethics, particularly at the university level, would allow the teaching of moral values and ethics to contribute meaningfully to the broader professional and industrial application of science.

Bioethics education at the higher-education level would serve the aims of curriculum bodies such as the University Grants Commission (UGC) not merely by conveying scientific knowledge and technical skill, but by forming professionals equipped with moral judgment, individuals capable of contributing to science and industry while confronting the bioethical dilemmas inherent in their fields with sound, timely, and ethically grounded decision-making.

In light of the ethical issues that inevitably accompany scientific invention and discovery, this paper concludes that bioethics should be introduced as a compulsory discipline across all levels of education from primary school through university, without distinction of subject stream: sciences, social sciences, humanities, fine and performing arts, physical education, medicine, law, engineering, management, politics, and philosophy alike.

Such a beginning can be made in stages, with pilot implementation, teacher preparation, and systematic evaluation, etc. A deliberate beginning in this direction is both overdue and achievable.

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