

CHAPTER TWENTY-SEVEN

A Critical Review of Ethical Issues in STEM Teacher Education in Nigeria

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Abstract

In an era where technological and scientific advancements are pivotal to national development, this study examined the state of STEM (Science, Technology, Engineering, and Mathematics) education in Nigeria. It aimed to dissect the complexities, challenges, and opportunities within this educational sector, particularly in the context of global educational trends and national developmental imperatives. The study reviewed ethical issues in STEM teacher education in Nigeria. It clarified the concepts of ethics, norms, and what constitutes STEM Teacher Education. The study concluded that, beyond professional ethics, STEM teachers also need grounding in ethical theories and moral thinking skills. The study advocated for the inclusion of core courses on ethical theories and moral thinking skills into the STEM teacher education curriculum in Nigeria.

Keywords: Education, Ethics, Ethical dilemma, STEM, Teacher education.

Introduction

The trajectory of Science, Technology, Engineering, and Mathematics (STEM) education in Nigeria has been a gradual process, marked by some challenges and opportunities. Arising from a global acknowledgement of the significance of the STEM field, and despite the progress made, STEM education in Nigeria still faces numerous challenges, including inadequate funding, unstable education policies, and a lack of adequate support (Agboola, 2021).

The government's acknowledgement of the importance of STEM fields led to the founding of several federal universities specialising in science and technology, with a specific focus on enhancing STEM teaching and learning. These institutions marked the beginning of a structured approach to STEM education in Nigeria, focusing on creating a skilled workforce capable of driving technological advancement and innovation. Despite the government's

investment in STEM education, the sector has struggled with a multitude of challenges, including inadequate resources, insufficient infrastructure, and a shortage of qualified educators. Agboola (2021) identified key challenges, including poverty, underfunded schools, untrained teachers, and lack of educational resources. These numerous significant challenges pose a threat to the successful implementation, growth, and sustainability of STEM education. Despite the efforts to promote STEM education, women and girls remain significantly underrepresented in these fields, with less than 30% of STEM researcher worldwide being women, and only around 35% of students enrolled in STEM-related higher education were female.

Tim (2017) noted that mankind is arguably the most dominant and intelligent species on earth with the most complex social behaviours. Ethics, according to Frolov (1984), is a theoretical field of study concerned with the studies of morality, which emerged during the early days of the slave-owning society. It emerged from the spontaneous moral consciousness of society. Peter (2020) noted that ethics is a branch of philosophy that deals with “what is morally good and bad as well as what is morally right and wrong”. Ethics applies to theory or any system of moral values or principles. Ethics has helped in the categorisation of different values such as integrity, discipline and honesty. Ethics influences our individual behaviours and guides in making the right decision. It is an important concept that helps to regulate life and act of responsible behaviour. The importance of ethics in society, and in the field of education in particular, cannot be over-emphasised. Ethics in education are generally essential as they play a prominent role in the smooth running of the education industry. It sets the standards of what is acceptable and what is not acceptable in teaching and learning situations. The onus then lies on teachers to share the acceptable ethics during their training to students to guide their daily conducts in society.

Norms, on the other hand, refers to a set of standardised ways of behaviour and conduct in a society, community or organisation. It deals with appropriate societal standards of behaviour, the morals used in making value judgments by individuals and society in general. According to Young (2015), norms are:

...patterns of behaviour that are self-enforcing within a group: Everyone conforms, everyone is expected to conform, and everyone wants to conform when they expect everyone else to conform. Social norms are often

sustained by multiple mechanisms, including a desire to coordinate, fear of being sanctioned, signalling membership in a group, or simply following the lead of others.

STEM Teacher Education can be conceptualised as comprehensive programmes which consist of pedagogical theory, disciplinary knowledge, teaching, and professional skills designed to produce professionally competent, efficient and effective teachers in the fields of Sciences, Technology, Engineering, and Mathematics. In general, teacher education is a specialised professional programme designed for prospective and in-service teachers to acquire knowledge, skills and attitudes necessary to make them efficient and effective facilitators of learning. (Osuji 2009).

Ethical Standards for STEM Teachers in Nigeria

The mandate of the education industry extends beyond the production of literate citizens, and the required manpower for sustainable national development. It also includes producing morally upright citizen for the common good of society. Indeed, teachers are often regarded as “Moral Compass” for students in view of their expected significant roles in moral upbringing of students. Hence, ethical issues and social norms take centre stage in the field of teacher education. Since teachers can teach only what they know, pre-service and in-service teachers are equipped with the required ethical standards and social norms through teacher education and teacher professional development programme.

Ethical standard in teacher education refers to code of conducts that regulate the behaviour and relationship of teachers with students, colleagues, school administration, parents as well as society. As observed by Rasmi, Lakshmipriya and Santosh (2014), ethical standards in teacher education deals with basic principles, procedures and behaviour patterns which is based on dedication and commitments to core values that are deeply rooted in education system. The Teacher Registration Council of Nigeria (TRCN) (2013) rightly noted that:

No profession can stand without clearly defined “dos” and “don’ts” representing the core values that the profession shares and holds tenaciously. Teaching in particular deals with the moulding of character of humanity and itself must

rest on a set of solid, tested and proven ethical framework that guarantees the very best atmosphere and trust in the teaching-learning process.

In keeping with international best practices and ethical standards in teaching profession, teacher education programmes mandatorily equips both pre-service and in-service-STEM teachers in Nigeria with professional ethics and norms. These professional ethics and norms otherwise known as teachers' code of conduct, which teachers are obliged to adhere to as spelt out by the TRCN (2013), are as follows:

- **Respect:** Teachers are obliged to respect each other in all circumstances irrespective of their cadre and must also assist each other to attain highest professional goals.
- **Symbiotic relationship:** All teachers are under obligation to establish symbiotic relationship with their colleagues for mutual benefits and uplifting the profession to a lofty height.
- **Responsibility:** Senior teachers are expected to display a high sense of responsibility and self-respect and take up the responsibility of bringing up junior colleagues professionally. Junior colleagues are under obligation to also respect their senior during formal and non-formal interactions; and must exhibit readiness to learn from them.
- **Loyalty:** Teachers are expected to exhibit a high sense of loyalty and co-operate with professional colleagues to enhance the achievement of professional goals.
- **Integrity:** Teachers are under obligation to display honesty, be trustworthy, and respect persons and property.
- **Discrimination:** Teachers are expected to have zero tolerance to discrimination on the basis of, religion, culture, race, gender, and so forth. They are, hence, obliged to relate equally with every person.
- **Defamation of colleagues:** In all circumstances, teachers are prohibited from making derogatory remarks about their colleagues; and should not lower each other's integrity.

- **Touting:** Teachers are prohibited from depriving their colleagues of clients and learners through misinformation, or any other unethical means.
- **Canvassing:** Teachers are forbidden to gain undue advantage over their colleagues by advertising themselves that they possess extraordinary knowledge and skills that they do not actually have.
- **Team work:** Whenever the need arises, teachers are expected to work as a team and equally seek for assistance from colleagues when undertaking tasks beyond their professional ability.
- **Plagiarism:** Teachers are under obligation to adhere very strictly to copyright laws and regulations. They are obliged to recognise the intellectual contributions of colleagues by refraining from all forms of plagiarism.

In addition to the forgoing ethics, guiding teacher's relationships with colleagues, there are also ethical standards that guide the relationship between teachers and students as summarised below:

- **Learner's right and dignity:** Teachers are required to respect the learner's right and dignity irrespective of their gender, race, religion, tribe, colour, physical characteristics, place of origin, age, and so forth.
- **Responsibility for educational programmes:** Teachers are required to professionally discharge their duties as facilitators of learning diligently.
- **Empathy:** Teachers are obliged to understand and share the feelings and circumstances of their students at all times.
- **Confidentiality:** Teachers are under obligation not to divulge students' confidential information except in the interest of the learner, parents/guardians, public and when required by law.
- **Fair remuneration:** Teachers are not expected to collect gratifications, bribes or any money for services already paid for by the employer.
- **Sexual misconduct and related abuse of office:** Teachers are prohibited from using their position to sexually harass, blackmail or intimidate their students. They are equally prohibited from promoting,

aiding and abetting sexual misconduct, drug addiction and trafficking, cultism, human trafficking among other criminal conducts.

- **Examination malpractice:** Teachers are prohibited from aiding and abetting examination malpractice by students.
- **Patronage of illegal learners' groups:** Teachers are required to refrain from patronising illegal and immoral student groups such as secrete cults, gay and lesbian.
- **Role model:** Teachers are obliged to serve as good role model to learners in their daily conducts such as decency in speech, mannerism, discipline, dressing and discharge of their duties.
- **Corrupt practice:** Teachers are prohibited from engaging in any form of corrupt practices such as asking or receiving gifts, gratification for themselves or for their colleagues.
- **Corporal punishment:** Teachers are forbidden to administer corporal punishment on their students without the permission of the school authority.
- **Discipline:** Teachers are to ensure that students behave in a civil and disciplined manner.
- **Ideological influence:** Teachers are prohibited from imposing or spreading their ideologies among learners.

There are also ethical standards that guide the relationships between the teachers and their employer, parents, and the public among other stakeholders. For instance, teachers are obliged to respect and provide relevant information about students and school to parents; take active parts in parent-teacher association. They are prohibited from taking gifts, favours, and hospitality from parents to avoid showing favouritism to any student. They are obliged to respect agreement between their union and employers, fulfil their contractual agreements with their employer and perform only tasks within their professional training (TRCN 2013).

Ethical Component of STEM

In addition to the forgoing ethical standards and norms, there are also, ethical standards that guide the daily activities of the scientific community such as curiosity, honesty, that constitute the ethical component of the structure of

science. According to Abimbola (2013), every STEM teacher should be conscious of these ethical standards, teach and exhibit them as professionals. They include but not limited to the following:

- **Seeking Relationship among Data:** Scientists should seek for relationship among data and formulate generalisation in form of concepts, laws and theories.
- **Anti-authoritarianism:** No scientist or group of scientists is allowed to enforce strict obedience to their authority at the expense of personal freedom of other scientists to conduct their research. Authority lies in the logic of man, data from nature, and the force of the scientific community.
- **Positive Approach to Failure:** Scientists should regard every failed attempt as an indication that there is a better way of doing it. The lesson from failure is that one way of not doing the same thing has been learnt. Scientists, therefore, should not become moody due to failure during experimentation.
- **Objectivity:** All scientists are under obligation to willingly consider many sides of an issue without any form of prejudice.
- **Open-mindedness:** Scientists are obliged to always willingly be receptive to new information or idea and examine all planned or unplanned information.
- **Commitment to the Goals of Science:** The goal of science is the formulation of relatively small number of basic concepts to explain natural phenomena.
- **Suspension of Judgments:** Scientists are obliged to always willingly suspend judgments in the absence of all necessary facts/date. Conclusions must be delayed until necessary facts are available.
- **Curiosity:** Scientists should be very curious, desiring to know more and thus must not be satisfied with the status quo.
- **Accurate Observation:** It is an obligation for every scientist to ensure that observations are accurately made and recorded. Although observations are theory-laden, it must be free from bias of the observer as far as possible.

- **Morality:** In the field of pure sciences, scientists are not under obligation to be concerned with the moral implications of their research work. However, in the field of applied sciences, scientists should consider the moral implications of their studies.
- **Communication:** Scientists should make their findings known to the scientific community.
- **Scepticism:** Scientists are to willingly question the status quo by maintaining some degree of a doubting attitude (Abimbola, 2013).

Unlike the teachers' code of conduct that features prominently in a compulsory course, (EDU 111: Introduction to Teaching Profession) in the teacher education curriculum in Nigerian universities, the ethical component of science does not have the same status.

Ethical Issues and Dilemmas Facing STEM Teachers

STEM teachers often encounter conflicting interests in dealing with ethical issues when discharging their responsibilities. For instance, a teacher may be mandated by the principal to teach a subject other than his/her field of specialisation. Unscrupulous school management sometimes equally engages teachers to aid and abet examination malpractices (WAEC, 2020) or to collect illegal financial charges. Sometimes, the school principal may mandate teachers to give preferential treatment to student(s) due to intense pressure from influential parents. Similarly, a teacher may be aware of close friend(s) among his/her colleagues that covertly violates ethical standards such as trading mark for sex, and falsification of grades. There are also situation where student(s), out of frustrations, act provocatively to embarrass the teacher in the class. These and many more similar scenarios abound in schools, posing ethical dilemmas for teachers on daily basis. Teachers are expected to resolve these ethical issues appropriately without jeopardising their job and professional standards.

Teachers need more than mere familiarity with professional code of conduct to resolve these ethical challenges. The understanding of ethical dilemmas and how to resolve them adequately can be achieved by the application of ethical theories and moral thinking skills such as the Four Component Model of Moral Maturity propounded by Rest and Narvaez (1994). When faced with ethical dilemmas there is a tendency to rely on the four-component model to resolve

the dilemmas. Three levels of moral maturity in resolving ethical dilemmas are recognised under the model as follow:

- a- The personal interest level: At this most basic level of moral maturity, dilemmas are resolved based on the direct advantage to the person under focus. There is no consideration of the impact of one's conduct on others; rather, emphasis is on doing what is considered to be the best for oneself, family and friends' approval. The need to serve one's interest is paramount at this level.
- b- The maintaining norms level: Resolution of dilemmas at this next level is on the basis of maintaining the existing legal system, rules, societal and professional norms. Conducts are considered to be right as long as it contributes to profession, group or society in general. Laws are strictly adhered to except in few exceptional cases.
- c- The post-conventional Level: This is the peak of moral maturity. Resolutions of ethical dilemmas are on the basis of general agreement through consensus such as majority vote, and appeal to moral principles such as adherence to due process and recognition of basic rights. The paramount focus is to uphold basic rights, societal values, and laws, even when they conflict with the rules and laws of the group.

Applying these three moral maturity levels to resolve ethical dilemmas in schools is not as easy as it seems to be. Naturally, teachers are sensitive about the ethical implications of their relationship with colleagues, students and other stakeholders. The three levels of moral maturity are thus a useful framework to address ethical dilemmas (Jacques, 2013). Ethical dilemmas calls for meaningful understanding of moral theories and their applications in real life situations by teachers. However, moral theories as a compulsory course are yet to be integrated into STEM teacher education in Nigeria.

Scientific and Technological Advancements do also raise ethical issues that STEM teachers have to respond to in the class. For instance, English (2019) reported that Chinese scientists are already producing 'designer babies' because advancements in genetics now enables scientists to edit human genome by altering the DNA sequences and change how genes function to prevent the spread of genetic diseases. This implies that scientists can now select and design the genetic qualities of a child to produce 'designer babies'. The long-time effects of this practice are unknown, and it calls into question

the definition human. Similarly, the trial of drugs and consumer products, such as cosmetics in animal, places the suffering of human over the sufferings of animals. While this may sound appropriate in cases of production of drugs to improve human health, it is a moral burden to subject animals to sufferings just to produce cosmetics (English, 2019). Experiments on human embryo and stem cell also raise ethical issues as they violate human dignity. Advancements in engineering have led to the evolution of autonomous machine such as driverless cars and killer drones. Autonomous machines work without human control and can take decision independent of human interference. The moral question here is: who is to be held accountable for the actions taken by these autonomous machines? (University of Notre Dame 2012).

STEM teachers are required to explain and discuss recent developments in their respective disciplines during class lessons. Hence, they have to be adequately prepared to address ethical issues that arose from such advancements with their students. To achieve this, STEM teachers need adequate grounding in ethical theories and moral thinking skills apart from keeping abreast with ethical issue related to the advancements in their field.

Conclusion

STEM teachers are expected to serve as moral compass in society. To this end, teacher education programme in Nigeria equipped them with professional ethical standards, which is also known as teachers' code of conduct. A society devoid of ethical conducts is inconceivable because individuals react differently to moral values and strict adherence to ethical standards is easier said than done. In discharging their responsibilities, STEM teachers often encounter ethical dilemmas almost on a daily basis. There seems to be no evidence in literature that teacher education programme in Nigeria equip STEM teachers with the ethical theories and moral thinking skills required to resolve ethical dilemmas. Similarly, the ethical component of the structure of science is yet to find a prominent place in STEM teacher education programme in Nigeria. STEM teachers obviously need beyond professional code of conduct; they also need grounding in ethical theories and moral thinking skills to address ethical dilemmas and issues in science and technology.

Recommendations

- The curriculum of STEM teacher education in Nigeria should be expanded to include course(s) on ethical theories and moral thinking

skills so as to enable teachers to adequately address ethical dilemmas they encounter when discharging their duties.

- The introduction of a course on STEM and Ethics should equally be integrated into the STEM teacher education programme.
- Teacher education institutions should place more emphasis on the ethical / moral conducts of STEM teachers right from the time they are admitted into teacher education programme.
- STEM teachers must always be conscious of their role not only as facilitators of learning but also as moral compass.
- Textbook authors should include ethical issues in teacher education, and in STEM textbooks.
- The Teachers' Registration Council of Nigeria, Science Teachers' Association of Nigeria, Mathematics Association of Nigeria, and Science Association of Nigeria should regularly keep teachers abreast of ethical issues in STEM through regular workshops and conferences.

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